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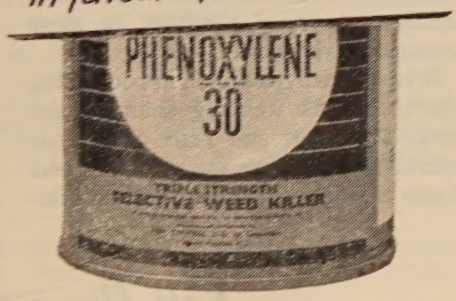

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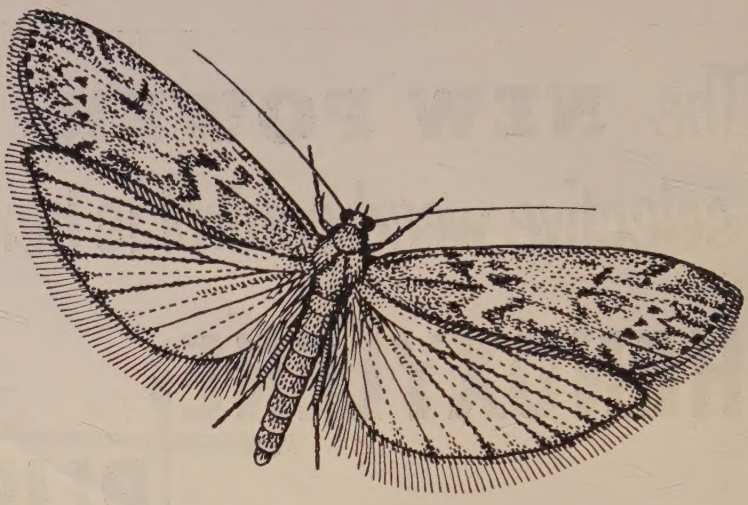

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URQUIJO LANDALUZE (P.). **Aplicación de la genética al aumento de la eficacia del *Trichogramma minutum* en la lucha biológica.** [The Application of Genetics to the Increase of the Efficiency of Biological Control by *T. minutum*.]—*Bol. Pat. veg. Ent. agric.* **18** (1950) pp. 1–12, 2 figs., 3 refs. Madrid, 1951.

The author reviews the work done in Spain on the breeding of selected strains of *Trichogramma minutum* Ril. [*cf. R.A.E.*, A **36** 200, etc.] and describes an improved apparatus for testing ovotropism [*loc. cit.*]. The ovotropism of the ten best strains was five times as great in 1949 as it had been in 1946. In field tests in north-western Spain in 1947–49, in which the parasite was released against *Cydia pomonella* (L.) on apple [*cf.* **33** 125], the percentage infestation was reduced to 16–17 on the trees on which the liberations had been made and 18–25 on adjacent trees, as compared with about 50 on more distant ones. The parasite has apparently given considerable control of *Gnorimoschema operculella* (Zell.) on stored potatoes in areas in which it has been released and is considered an important factor in the recent decline in importance of this pest in certain north-western districts.

GÓMEZ CLEMENTE (F.). **Ensayos de aclimatación de *Leptomastix dactylopii* Howard, parásito del " cotonet " o " algodón " de los agrios (*Pseudococcus citri* Risso).** [Experiments on the Acclimatisation of *L. dactylopii*, a Parasite of *Planococcus citri*.]—*Bol. Pat. veg. Ent. agric.* **18** (1950) pp. 21–28, 8 figs. Madrid, 1951.

Adults of *Leptomastix dactylopii* How. were sent in August 1948 from California to Valencia for experiments on its value for the control of *Planococcus (Pseudococcus) citri* (Risso) on *Citrus* there. The Encyrtid was reared in the laboratory on *P. citri* on potato sprouts. The females oviposited in hosts in the early instars, and development from oviposition to the appearance of the adult parasites lasted 13–36 days, depending on the season. The adults lived for 15–20 days in summer and 30–35 days in autumn and spring. The number of eggs laid per female was not known, but two pairs gave rise to a total of 421 adult progeny in 46 days and four other pairs to 12, 21, 64 and 108, respectively. Only one adult developed from each parasitised host, though up to four larvae were observed in some.

GÓMEZ-MENOR (J.). **Homópteros que atacan a los frutales.** [Homoptera that attack Fruit Trees.]—*Bol. Pat. veg. Ent. agric.* **18** (1950) pp. 51–88, 25 figs., 21 refs. Madrid, 1951.

The author gives a key to the superfamilies and families of the Homoptera Auchenorrhyncha, followed by notes on the morphology of the families and genera of economic importance, with keys to the genera in many cases, and of the species that are injurious to fruit trees in Spain. The habits and food-plants of the latter are briefly recorded, mainly from the literature.

MORALES AGACINO (E.). **Las ootecas de los Acrídidos.** [The Egg-pods of Acridids.]—*Bol. Pat. veg. Ent. agric.* **18** (1950) pp. 89–109, 18 figs., 5 refs. Madrid, 1951.

In this paper, which is based largely on the work of Zimin [*R.A.E.*, A **26** 246], the author gives general descriptions of the egg-pods and eggs of

Acridids, notes on the positions in which they are deposited, and a key to the egg-pods of nine species of importance in Spain, with descriptions of them and, when known, of the eggs themselves.

Alfaro (A.). **Algunos aspectos de los insecticidas agrícolas a base de DDT y HCH.** [Some Aspects of the agricultural Insecticides based on DDT and BHC.]—*Bol. Pat. veg. Ent. agric.* **18** (1950) pp. 111–121, 3 refs. Madrid, 1951.

In view of divergent results obtained in practice, the properties of various Spanish proprietary wettable powders containing DDT or BHC were investigated [*cf. R.A.E.*, A **39** 69, etc.]. It was found in the laboratory that although they mostly contained the proportions of insecticide claimed by the manufacturers, the amount of p,p′ isomer in the DDT varied considerably, and the stability of the suspensions formed in water (tested by a technique involving the sampling of the upper half of a suspension in a test-tube six minutes after agitation) was also variable, owing to differences in the particle size of the active ingredients, the nature of the inert ingredients and the density of the products. These differences were reflected in field tests in which third-instar larvae and adults of *Leptinotarsa decemlineata* (Say) were placed on potato plants that had been sprayed with the products at similar concentrations of DDT or BHC immediately or five days previously.

Alfaro (A.). **La invasión del escarabajo de la patata y problemas planteados.** [The Invasion by *Leptinotarsa decemlineata* and the Problems involved.]—*Bol. Pat. veg. Ent. agric.* **18** (1950) pp. 139–175, 5 figs., 26 refs. Madrid, 1951.

The author outlines the history of the spread of *Leptinotarsa decemlineata* (Say) on potato across the United States and western and southern Europe, with particular reference to its advance through Spain [*cf. R.A.E.*, A **36** 196, etc.], where the beetle was present in every Province by 1950 though infestation was still not general in the extreme south. Its food-plants and the climatic factors favouring infestation are reviewed [**34** 264], and the natural enemies and chemical control of the insect are discussed. The production of potatoes in Spain between 1940 and 1950 and the degree of infestation are illustrated on a graph, and it is shown that losses have been consistently small, largely owing to the control measures applied.

Benlloch (M.). **El ensayo de la suspensión en los preparados a base de DDT o gammahexano.** [Testing Suspensions of Preparations of DDT and BHC.]—*Bol. Pat. veg. Ent. agric.* **18** (1950) pp. 177–180. Madrid, 1951.

The ability of 15 wettable powders of Spanish manufacture containing DDT or BHC to form stable suspensions in water was tested by preparing 500 cc. 1 per cent. suspension of each in large test-tubes, siphoning off the top nine-tenths after ten minutes, and filtering, drying and weighing the sediment in the remainder. It was considered that the amount of sediment should not exceed 50 per cent. of the total product in suspension under these conditions, and it should be considerably less, probably not more than 25 per cent., if the products have a high content of active principle and

are diluted to less than 0·5 per cent. Of the products tested, four were unsatisfactory, with 57·5–78·8 per cent. sedimentation, five were good, with 11·9–22·7 per cent. sedimentation, and six were tolerable, with 28·9–45·5 per cent. sedimentation. It was found, however, that the percentage of toxicant in the sediment was sometimes higher than the percentage of the total product, owing to the particles of the former being coarser than those of the inert ingredients. In further tests with four powders, it was found that sediments of 44·2, 28·9, 34·6 and 13·7 per cent. of the total product contained 66·9, 44·7, 50·4 and 21·9 per cent., respectively, of the total toxicant, so that the first and third of these products were in reality unsatisfactory though they had previously been classed as tolerable.

Domínguez García-Tejero (F.). **Distribución en España de las plagas y enfermedades de la remolacha.** [The Distribution in Spain of Pests and Diseases of Beet.]—*Bol. Pat. veg. Ent. agric.* **18** (1950) pp. 181–204, 21 figs., 1 map, 14 refs. Madrid, 1951.

The author gives a map showing the distribution of the principal pests and diseases of beet in Spain, with notes on the damage caused and detailed locality records covering a period of some 26 years. The insects comprise *Chaetocnema tibialis* (Ill.), *Cassida vittata* Vill., *Cleonus* (*Conorrhynchus*) *mendicus* (Gylh.), five species of *Lixus* [*cf. R.A.E.*, A **33** 166], *Laphygma exigua* (Hb.) and *Pegomyia hyoscyami* var. *betae* (Curt.).

Gómez Clemente (F.) & Bellod (M.). **Nuevo procedimiento de lucha contra el *Dacus oleae* Rossi.** [A new Method for the Control of *D. oleae*.]—*Bol. Pat. veg. Ent. agric.* **18** (1950) pp. 205–241, 2 figs., 18 graphs, refs. Madrid, 1951.

The distribution of *Dacus oleae* (Gmel.) on olive in Spain is described [*cf. R.A.E.*, A **39** 418, etc.] and shown on a map, and an account is given of studies made near Valencia in 1942–49 on the use of bait-traps of a type already noticed [**35** 151] for its control. The attractant used was ammonium phosphate, which was at first diluted to 5 per cent. and renewed every 10 days, but it was shown in 1943–45 that 2 and 4 per cent. solutions were more effective than stronger ones [**36** 201], in 1946–48 that the liquid in the traps had not evaporated completely even after 56 days, and in 1947–48 that a 2 per cent. solution did not lose its attractiveness for 28–42 days. A concentration of 2 per cent. was therefore recommended, with the liquid renewed every 30 days. Investigations in 1948–49 indicated that high proportions of the females attracted contained mature eggs. In a test in 1944, bait-sprays, bait-pans, bait-traps and combinations of bait-traps and bait-sprays were compared, and it was found that the combined method was not significantly more effective than the use of the bait-traps alone, and the latter significantly better than a bait-spray. The traps should be installed just before the olives become susceptible to attack, at the rate of one to every four trees, and the rate should be gradually increased to one to each tree as the numbers of adults taken rise. Graphs are given showing the relation of trap-catches to temperature and humidity in 1943–48, from which it is concluded that high relative humidity is a limiting factor. There appeared to be four generations a year [**39** 418], the adults appearing in June and July (from overwintering pupae), mid-August, mid-September and mid-October. Infestation was apparently in inverse proportion to the size of the previous year's crop.

DEL CAÑIZO GÓMEZ (J.). **Una plaga de los frutales de hueso: el " gusano cabezudo "** (*Capnodis tenebrionis* **(L.)**). [A Pest of Stone-fruit Trees, *C. tenebrionis.*]—*Bol. Pat. veg. Ent. agric.* **18** (1950) pp. 281–298, 5 figs., refs. Madrid, 1951.

Considerable damage is caused to stone-fruit trees, particularly apricot, peach and plum, on the Mediterranean coast of Spain by *Capnodis tenebrionis* (L.). The author gives brief descriptions of the larva and adults of this Buprestid, an account of its bionomics based largely on the literature [*cf. R.A.E.*, A **34** 369; **41** 192, etc.], a list of its recorded natural enemies, and directions for its control by spreading p-dichlorobenezene on the ground round the trees at a little distance from them and mounding the trunks with soil, or by the use of ethylene-dichloride emulsion [**35** 214], which has not so far been tested in Spain.

RUSSO (G.) & SANTORO (R.). **Esperimenti di lotta antidacica eseguiti in Ascea (Salerno) nel 1950.** [Experiments in Ascea (Salerno) in 1950 on the Control of *Dacus oleae.*]—*Boll. Lab. Ent. agr. Portici* **11** pp. 1–50, 14 figs. Portici, 1952. **Esperimenti di lotta antidacica eseguiti in Ascea Marina (Salerno) nel 1951.** [Experiments in Ascea Marina (Salerno) in 1951 on the Control of *D. oleae.*]—*T.c.* pp. 256–311, 10 figs., 1 fldg. table, 1 ref. (With Summaries in English.)

These two papers comprise accounts of experiments carried out near Salerno, Italy, on the effectiveness of various repellent sprays of the type recommended by Russo [*R.A.E.*, A **26** 350], bait-sprays, chlorinated hydrocarbons and parathion against *Dacus oleae* (Gmel.) on olive in 1950 and 1951, respectively.

In 1950, the repellent sprays consisted mainly of bentonite and sulphur, separately or together, and usually with the addition of an adhesive, or bordeaux mixture at the normal concentration or with an increased lime content. They were applied four times, between 20th July and 3rd October and gave fairly good protection until the deposits were washed away by the heavy October rains, after which infestation increased rapidly. They are thus effective only if the olives are to be picked early.

In the main tests with chlorinated hydrocarbons, the sprays [**41** 109] were applied on 21st–22nd July or 2nd–4th August, and on 29th–31st August, 10th–12th September (following rain) and 4th–6th October. Chlordane alone gave little or no protection after September and the mixture of chlordane and DDT was only slightly better, but the mixture of 25 per cent. technical DDT and 25 per cent. γ BHC and the 50 per cent. colloidal DDT paste resulted in 75·1 and 77·5 per cent. uninjured fruits, respectively, on 10th November, as compared with less than 1 per cent. for no treatment, and in 77·88 and 82·65 per cent. if the fruits that had been punctured but in which eggs had not been laid or had not hatched were included. In a subsidiary test with two DDT preparations remaining from 1949, the colloidal paste and a 33 per cent. emulsion concentrate, both at 4 lb. in 10 gals. water, were applied four times between 3rd August and 4th October and resulted, respectively, in 85·4 and 70·2 per cent. uninjured or superficially injured fruits on 10th November, as compared with none in the controls, and had thus lost none of their effectiveness in storage.

Parathion was used at 0·03 per cent. in a spray and 2 per cent. in a dust, and was applied on 12th September, 4th October and 12th November. Treatment was begun too late, as some of the olives contained full-fed

larvae by 12th September and all were infested in October, but examination on 3rd November showed that 83·7 and 75·6 per cent., respectively, of the olives on the dusted and sprayed trees were injured only superficially or contained larvae that had been killed in the early stages of development [*cf.* **41** 110]. On 10th November, the percentages were 51·11 and 57·5.

In 1951, infestation by *D. oleae* was delayed by high summer temperatures and low humidity, but was severe late in the season. The colloidal DDT paste at 3 or 4 per cent. in sprays prepared with or without heat and applied in mid-July, early September, early October and late October or early November gave good results, with no significant differences between concentrations or methods of preparation, and the percentages of uninjured olives on the treated trees on 27th November were 78–92·7 as compared with 11·3–11·6 in the controls. In one block treated at 4 per cent., 95·6 per cent. of the olives were uninjured on 21st December, as compared with 5·8. A sample of the product prepared in 1949 and applied at 4 and 3 per cent. in sprays prepared with and without heat, respectively, gave 52·5 and 31·1 per cent. sound olives on 27th November, as compared with 8·2 per cent. The mixture of DDT and γ BHC was applied at 3 and 4 per cent. on about the same four dates, and the percentages of sound fruits on the treated and (in brackets) untreated trees were 95·2 and 99·3 (59·2) on 10th November, 99·7 and 99·4 (37·1) on 27th November and 98·6 and 98·6 (21·6) on 21st December. Dieldrin in emulsion sprays prepared from a concentrate of unspecified strength and applied on 25th July, 5th September, 6th October and 31st October gave 72·1, 76·7 and 95·9 per cent. sound fruits on 10th November, 27th November and 21st December, respectively, as compared with 52·8, 31·6 and 11·3 for no treatment, and is regarded as promising. A mixture of unspecified synthetic organic chemicals in mineral oils also gave fair results.

Parathion was applied at 0·08, 0·1 and 0·12 per cent. in wettable-powder sprays on 10th October and 7th November, after infestation had already begun. The percentages of sound fruits on the treated and (in brackets) untreated trees were 72·8, 79·7 and 74·6 (27·5) on 10th November, 76·5, 75·2 and 68 (23·8) on 27th November, and 99·4 (5·8) for 0·1 per cent. parathion on 21st December. Most of the dead larvae found in the fruits were in the early instars, and many dead adults were found beneath the trees after spraying. Dusts of 3 and 4 per cent. parathion were applied on 10th October and 7th November, and the percentages of sound fruits were 78 and 48·2, respectively, on 10th November, 75·9 and 50·1 on 27th November and 91·9 for both concentrations on 21st December, as compared with 27·5, 23·8 and 5·84 on these three dates for no treatment.

In tests with bait-sprays, a mixture of 95 lb. molasses, 2·5 lb. sodium arsenite and 2 pints water diluted 1 : 9 was applied on 14th July, 7th September, 8th October and 6th November, according to Berlese's method, and in cycles beginning on 14th July, 8th August, 2nd September and 8th October according to Bellio's modification of it [*cf.* **41** 343]. The second method was better than the first, but neither procedure gave adequate protection against the heavy infestation that developed in October. Another sweetened arsenical bait-spray proved somewhat superior, but treatment was not begun until 23rd August and protection throughout the season was again only moderate. Repellent sprays of clay and a wetting agent, alone or with lime-sulphur, or of bentonite, a wetting agent and parathion, applied to single trees on 18th July, 6th September and 6th and 31st October, adhered well and gave reasonable protection until heavy rain fell, and appeared useful for olives to be picked not later than November.

Frediani (D.). **Contributo alla conoscenza della** *Sesamia cretica* **Led. (Lepidoptera-Noctuidae).** [A Contribution to Knowledge of *S. cretica*.] —*Boll. Lab. Ent. agr. Portici* **11** pp. 51–98, 30 figs., 39 refs. Portici, 1952. (With a Summary in English.)

The author describes all stages of *Sesamia cretica* (Led.), reviews its distribution and food-plants [*cf. R.A.E.*, A **41** 68] and gives an account of observations on its bionomics on maize in the Province of Pisa, Italy, in 1946–50.

The full-fed larvae overwintered in maize stalks left in the fields after harvest or stored indoors. They pupated in spring, the first adults emerged between 28th April and 15th May, depending on temperature, and pairing and oviposition occurred within a few days of emergence. Eggs were observed on the upper surface of a young maize leaf in the field, but were also found on the stalks and the surface of the ground in cages. In the laboratory, the adults survived for 8–15 days with sugar solution or honey and water provided as food. The females laid 50–100 eggs daily for several days. The larvae hatched in 10–12 days, fed for 4–5 days on the outside of the leaves and then bored into the stalks. The tassels were frequently injured in June–July. The pupal stage was passed in the larval galleries or in the axils of the leaves and lasted 20–25 days, and the adults emerged in July and August. Larvae of the second generation, which overwinter, hatched in 8–10 days, bored in the stems, usually the lower portions, and cobs, and fed externally on the ears, causing more serious damage than those of the first generation. In 1946, 70–90 per cent. of the plants in two localities were heavily attacked.

No natural enemies were found, but many of the larvae overwintering in the stored stalks died when the humidity was low. Control methods are reviewed [*cf.* **23** 521]. In tests, dusts and sprays of DDT, BHC and a mixture of BHC and thiocyanates (Tiogamma) gave rapid mortality of young larvae in the laboratory, and BHC was also effective against older larvae, but none of the materials was satisfactory in the field, even against young larvae, owing to the difficulty of reaching them.

Carilli (A.). **La Sesamia e la Piralide. Note biografiche, infestazione e danni da loro causati alle coltivazioni di granturco in provincia di Salerno.** [Notes on the Bionomics of *Sesamia cretica* and *Pyrausta nubilalis* and the Damage caused by them to Maize in the Province of Salerno.]—*Boll. Lab. Ent. agr. Portici* **11** pp. 99–108, 2 figs., 2 refs. Portici, 1952. (With a Summary in English.)

Sesamia cretica (Led.) and *Pyrausta nubilalis* (Hb.) cause considerable injury to maize in the Province of Salerno, Italy and were particularly injurious in 1946–49. Their bionomics are similar, but the eggs of *Pyrausta* are laid in groups of 15–20 and not singly or in pairs, as are usually those of *Sesamia*. The larvae of *P. nubilalis* require 35–40 days to become full-fed and those of *S. cretica* slightly less. The older larvae of *P. nubilalis* feed in the middle or upper part of the stalk, whereas those of *S. cretica* are usually found in the lower third [*cf.* preceding abstract]. The percentages of plants damaged amount to some 50–60 in spring and 90–100 in summer, but there are variations in different parts of the Province, which are briefly discussed.

The commonest parasites of *P. nubilalis* found in the area are *Eulophus viridulus* Thoms., *Lydella stabulans* var. *grisescens* R.-D. and *Zenillia roseanae* (B. & B.), which attack the larvae, and *Trichogramma evanescens*

Westw., which parasitises the eggs. No parasites of *Sesamia* are known in Italy. Cultural methods of control comprise cutting the maize low, ploughing the stubs into the ground, and destroying all stalks before adult emergence in spring. A decree of 6th December 1950, requires the destruction of all maize stalks before 15th April each year.

Frediani (D.). **Contributo alla conoscenza del *Rhynchites bacchus* L. (Coleoptera-Curculionidae).** [A Contribution to Knowledge of *R. bacchus*.]—*Boll. Lab. Ent. agr. Portici* **11** pp. 109–148, 28 figs., 24 refs. Portici, 1952. (With a Summary in English.)

All stages of *Rhynchites bacchus* (L.) are described, its distribution and food-plants are reviewed, and an account is given of studies in 1948–51 on its bionomics and control in the Province of Pisa, Italy, where it causes considerable damage to various fruits, especially plum and apple. Losses of these two fruits were heavy (60–70 per cent.) in 1949, and normal (30 per cent.) in 1950–51. Overwintered adults were first observed in the different years between 10th March and 6th April and fed on the buds, leaves and small fruits for 2–3 weeks before pairing. The eggs were laid singly in cavities in the fruits made by the female, up to five eggs being observed in one small apple. Oviposition occurred from April to July, and the maximum number of eggs laid per female in cages was 60. The larvae hatched in 7–10 days and penetrated directly into the interior of the fruits, where they fed on the seeds. Infested fruits fell or became mummified on the trees. The full-fed larvae overwintered in the fallen fruits or in cells in the soil and remained in diapause until the end of the following summer, when those in the fallen fruits left them and entered the soil and all pupated. The pupal stage lasted about 20 days, and the adults remained within the cells for 5–7 days after emerging and then overwintered beneath loose bark.

Fruits attacked by *R. bacchus*, whether they remain on the trees or fall to the ground, should be collected and destroyed. Many of the adults can be trapped beneath bands placed on the trunks at the end of summer or jarred from the trees in spring. DDT proved effective against the adults in the laboratory, and when suspension sprays of 1 or 1·5 per cent. Gesarol (containing 10 per cent. DDT) were applied to trees in the field and adults were subsequently caged on the branches, mortality was complete in 12 hours.

Scognamiglio (A.). **Un attacco di *Cossus cossus* L. a piante di pesco.** [An Attack of *C. cossus* on Peach.]—*Boll. Lab. Ent. agr. Portici* **11** pp. 183–192, 7 figs., 9 refs. Portici, 1952. (With a Summary in English.)

During observations in a mixed orchard near Salerno, Italy, in August 1951, peach trees were found to be attacked by *Cossus cossus* (L.), which had not previously been recorded on this food-plant. The infestation occurred in the region of the root-collar in all but three of the 127 trees concerned and was limited to the bark and outer layer of the wood, though the larvae penetrated deeper and were found higher up the trunk on apple and pear. On a few of the peach trees, parts of the bark had fallen away, exposing the superficial cavities made by the larvae in the wood. Many larvae were found on the ground, either hidden or exposed, and in the upper 8 ins. of soil immediately round the trees. Cocoons were observed round the

base of the trees just below soil level. It is thought that the larvae migrate from tree to tree during their feeding period. Details are given of eight trees examined; the number of larvae found on and round each ranged up to 51.

Jannone (G.). **Contributi alla conoscenza morfo-biologica e sistematica dell'Ortotterofauna dell'Eritrea. VI. Numero e successione delle generazioni annuali di** *Schistocerca gregaria* **(Forsk.) ph.** *gregaria* **di possibile sviluppo in Eritrea durante un ciclo evolutivo.** [Contributions to the morpho-biological and systematic Study of Eritrean Orthoptera. VI. The Number and Succession of the annual Generations of *S. gregaria* that develop in Eritrea during an evolutionary Cycle.]—*Boll. Lab. Ent. agr. Portici* **11** pp. 193–215, 1 fig., 3 refs. Portici, 1952. (With a Summary in English.)

In the course of observations on *Schistocerca gregaria* (Forsk.) phase *gregaria* in Eritrea in 1939–46, particular attention was paid to the number of generations developing each year within the country, apart from the swarms that enter from neighbouring regions. It was previously thought that only two generations could develop during the year, corresponding to the rainy seasons, but observations in 1944–45 during the recent outbreak showed that four generations and the early stages of a fifth were completed within little more than 12 months as a result of migration to areas suitable for sexual maturation.

Swarms from the west and north oviposited in the eastern and western lowlands and lower plateaux in June and July 1944. Adults originating from these eggs joined other swarms from the north and north-west in late September, ranged over Eritrea, Ethiopia and the Anglo-Egyptian Sudan throughout October and returned in early December to the eastern foothills and the Red Sea coast, where they oviposited and a second generation hatched in December. A third generation hatched in the eastern lowlands in March 1945 and, joining swarms from the neighbouring countries, migrated to the highlands and to Ethiopia in April and early May, returned to Eritrea in mid-May and oviposited in the western and eastern lowlands. The fourth generation hatched at the beginning of June. The adults became sexually mature in late July and oviposited in August, and a fifth generation hatched in September.

Although climatic conditions were particularly favourable in 1944–45, there is considerable likelihood of large scale hatching in June from eggs laid in May, with the result that two generations develop in the lowlands during the period from shortly before to shortly after the rains.

Roberti (D.). *L'Haematoloma dorsatum* **(Germ.) (Hemiptera-Homoptera-Cercopidae) dannoso al pino in Abruzzo.** [*Cercopis dorsata* damaging Pines in Abruzzo.]—*Boll. Lab. Ent. agr. Portici* **11** pp. 216–219, 2 figs., 5 refs. Portici, 1952. (With a Summary in English.)

In 1948–49, severe damage to *Pinus nigra* in a young plantation near Aquila, Italy, was found to be caused by *Cercopis* (*Haematoloma*) *dorsata* Germ., the adult female of which is briefly described. The adults, which appear in spring, fed on the needles of the young shoots, causing them to turn yellow and dry up and arresting the development of the trees. The eggs are usually laid in the soil or among dry leaves, and the nymphs feed on the sap of plant roots.

Roberti (D.). **Contributo alla conoscenza dell' *Hyponomeuta rorellus* Hb.** [A Contribution to Knowledge of *H. rorellus*.]—*Boll. Lab. Ent. agr. Portici* **11** pp. 220–233, 13 figs., 5 refs. Portici, 1952. (With a Summary in English.)

The author describes the larva, pupa and adults of both sexes of *Hyponomeuta rorellus* (Hb.), which caused almost complete defoliation of willows (*Salix viminalis* and *S. incana*) over a small area in the Province of Aquila, Italy, in June 1949. The Tachinid, *Erythrocera scutellaris* (R.-D.), was reared from some of the pupae.

Mariani (M.). **Nuove applicazioni di composti quaternari d'ammonio e di sostanze insetticide. Conservazione e restauro delle collezioni entomologiche e note sulla tecnica di preparazione e ripreparazione degli insetti.** [New Applications of quaternary Ammonium Compounds and insecticidal Substances. Conservation and Restoration of entomological Collections and Notes on the Technique of the Preparation and Repreparation of Insects.]—*Boll. Lab. Ent. agr. Portici* **11** pp. 234–242, 2 figs., 5 refs. Portici, 1952.

It is reported in the course of this paper that a small cellophane envelope containing 0·5 gm. γ BHC mixed with geraniol, placed in a case of insect specimens and pierced with a pin, protected the contents from attack by insects for three years, whereas specimens in an unprotected case in the same room were completely destroyed and numerous Psocids, Lepismids and adults of *Anthrenus* were present.

Roberti (D.). **Le oplocampe del susino. III. *Hoplocampa minuta* Christ.** [*Hoplocampa* spp. on Plum. III. *H. minuta*.]—*Boll. Lab. Ent. agr. Portici* **11** pp. 243–255, 8 figs., 10 refs. Portici, 1952. (With a Summary in English.)

In this third part of a series [*cf. R.A.E.*, A **41** 240], the author describes all stages of *Hoplocampa minuta* (Christ), reviews its distribution, foodplants and bionomics, and gives an account of experiments in 1951 on its control on plum in two localities near Avellino, Campania. In these, 0·1 and 0·2 per cent. DDT in emulsion and wettable-powder sprays, respectively, and 0·12 per cent. γ BHC in a wettable-powder spray were applied on 6th April, when the eggs were beginning to hatch and the flowers had lost three quarters of their petals. Inspection on 22nd April showed that the percentages of fruits infested in the two localities were reduced from 75–94 and 25–28 for no treatment to 0–1 and 0 by 0·1 per cent. DDT, 7–11 and 4–5 by 0·2 per cent. DDT and 2–5 and 2–4 by BHC.

Boselli (F.). **Esperimenti di lotta con DDT contro la *Ceratitis capitata* Wied. in Sardegna nel 1951.** [Experiments with DDT against *C. capitata* in Sardinia in 1951.]—*Ann. Sper. agr.* (N.S.) **6** no. 4 pp. 1011–1020, 1 ref. Rome, 1952. (With a Summary in English.)

Ceratitis capitata (Wied.) caused at least 80 per cent. loss of peaches in Sardinia in 1950 and also caused serious damage to other fruits, including apple, pear and orange. In view of this, experiments on its control were made in four peach orchards near Cagliari in 1951. The spray used was an emulsified solution of 0·25 per cent. DDT, and it was applied 3–8 times according to the catches of adults in bait-pans. Infestation was negligible

in one orchard consisting mainly of young trees, and three applications in July completely protected the fruits from attack. In another, the percentage infestation was only about 5 on trees sprayed four times between late June and early August, as compared with 40–85 in neighbouring untreated orchards, and in the third and fourth, seven and eight applications between late June and mid-August reduced the average infestation for the season to about 14·3 and 13·3 per cent., respectively, as compared with 80 per cent. for no treatment. The cost of spraying is discussed, and treatment is shown to be profitable even though complete protection is not obtained.

Gasser (R.). **Zur Kenntnis der gemeinen Spinnmilbe *Tetranychus urticae* Koch. 1. Mitteilung: Morphologie, Anatomie, Biologie und Oekologie.** [Contributions to Knowledge of the Common Spider Mite, *T. telarius*. First Communication: Morphology, Anatomy, Biology and Ecology.]—*Mitt. schweiz. ent. Ges.* **24** pt. 3 pp. 217–262, 10 figs., 76 refs. Berne, 1951. (With Summaries in French and English.)

In view of a considerable recent increase in the importance of Tetranychid mites on fruit trees in Switzerland [*cf. R.A.E.*, A **41** 180], investigations were begun on the bionomics, ecology and control of *Tetranychus telarius* (L.) (*urticae* Koch). In this first part, the author reviews the synonymy, distribution and food-plants of the mite, describes all stages and the anatomy of the adults, and gives the results of observations on its development on beans in the laboratory, comparing them with data in the literature. Both sexes passed through one larval and two nymphal stages (protonymph and deutonymph), each of the three terminating in a quiescent period (the nympho-, deuto- and teleiochrysalis). Sexual dimorphism was first apparent in the deutonymph, and some females were fertilised in this stage. The durations of the various stages at temperatures of 14–30°C. [57·2–86°F.] are shown in tables. During spring and summer, the females lived for 3–5 weeks, and the pre-oviposition period lasted 1–3 days at 19°C. [66·2°F.]. At 18–20°C. [64·4–68°F.], the average and (in brackets) maximum numbers of eggs laid daily were 4·5 (12), and the corresponding total numbers were 67·7 (117). The ratio of males to females was 1 : 2. Unfertilised eggs gave rise to males only. Only adults, nearly all of them females, overwintered. In investigations on the red coloration of overwintering individuals, the typical colour was shown in 5–7 days, even in summer, by mites placed on dry bean leaves, although the reverse process on transference to fresh leaves was less easily and sometimes never completely effected, particularly in late autumn and winter.

Grob (H.). **Beobachtungen über den Populationsverlauf der Spinnmilben in der Westschweiz.** [Observations on Fluctuations in Spider-mite Populations in western Switzerland.]—*Mitt. schweiz. ent. Ges.* **24** pt. 3 pp. 263–278, 4 graphs, 13 refs. Berne, 1951.

The author reviews the bionomics and seasonal occurrence of *Paratetranychus pilosus* (C. & F.), *Tetranychus telarius* (L.) (*urticae* Koch) and *Bryobia practiosa* Koch on apple in Switzerland [*cf. R.A.E.*, A **41** 180] and describes observations on the development of the infestation in orchards infested by one, two or all three of these mites in the west of the country in 1949 and 1950, and on control.

B. practiosa was found only in old-established orchards and was well controlled by sprays of lime-sulphur or wettable sulphur applied before the

flowering period. In tests of winter ovicides against *P. pilosus*, tar distillate (carbolineum) or DNC alone was unsatisfactory, but sprays of DNC in oil generally gave good results. Where infestation was heavy, further treatment in summer was necessary, but since most summer acaricides have little ovicidal effect, this proved successful only when directed against the nymphs from the overwintered eggs. The best results were given by a single application of parathion in mid-May, before many summer eggs had been deposited. The population did not regain its original density until the end of July, and although infestation in August was heavier for this treatment than for any other, the outbreak occurred too late to cause significant damage to leaves or fruit. Very few natural enemies of the mite were present up to early June, and those collected beneath the trees in August, when sprays were applied, were mainly *Anthocoris nemorum* (L.) and *Orius minutus* (L.), though *Stethorus* (*Scymnus*) *punctillum* Weise was also present in small numbers.

No satisfactory treatment against *T. telarius* was found. The adults are inaccessible in winter, and no acaricide gave good control of all stages in summer while remaining effective for long enough to prevent reinfestation from weeds.

Gasser (R.). **Über ein neues Insektizid mit breitem Wirkungsspektrum.** [On a new Insecticide with a wide Range of Effectiveness.]—*Z. Naturf.* **8b** pt. 5 pp. 225–232, refs. Tübingen, 1953. (With a Summary in English.)

Investigations in Switzerland on the development of materials toxic to a wide range of insects and other arthropods but relatively harmless to mammals resulted in the production of O,O-diethyl O-(2-isopropyl-4-methyl-pyrimidyl (6)) thiophosphate, referred to as Diazinon or G 24 480. It is a colourless liquid boiling at 83–84°C., with a density of 1·116–1·118 and a solubility of 0·004 per cent. in water at 20°C., is miscible with ether, alcohol, benzene and other hydrocarbon solvents, and is more stable in alkaline than in acid or neutral media. Its vapour pressure is about five times that of parathion. The technical product contains about 95 per cent. active ingredient. In tests of acute oral toxicity to laboratory animals, the median lethal doses of Diazinon for rats and mice in cu. mm. per kg. body weight were 235 and 96 in gum arabic, 220 and 70 in a 20 per cent. emulsifiable solution (G 24 525), and 712·5 and 122·5 in a 25 per cent. spray powder (G 24 939). Tests of chronic toxicity showed that the average lengths of life of male and female rats receiving daily doses of 50 cu. mm. Diazinon per kg. body weight six days a week in the emulsifiable solution were 36 and 85 days, respectively, and in a similar test with rats receiving 10 cu. mm. per kg. per day, the figures were 250 and 89 for Diazinon and 0·4 and 5·4 for parathion. The mode of action and symptoms of poisoning in insects resembled those of parathion, except that Diazinon was more rapid in action. Both it and two further compounds, diethyl 3-methyl-pyrazolyl(5) phosphate (Pyrazoxon) and O,O-diethyl O-(3-methyl-pyrazolyl(5)) thiophosphate (Pyrazothion) were more effective than parathion in inhibiting cholinesterase from human red blood corpuscles and pseudocholinesterase from human plasma.

The toxicity of Diazinon to arthropods is mainly by contact, though it also has some stomach and fumigant effect. It is not toxic to nematodes. In tests on the contact action of deposits on glass, the lowest amounts per 100 sq. cm. that gave complete mortality were 0·01 mg. for *Formica rufa* L., *Calandra granaria* (L.), *Tribolium confusum* Duv. and *Bruchus* (*Bruchidius*) *obtectus* Say, 0·1 mg. for larvae of *Tenebrio molitor* L., and

1 mg. for larvae of *Ephestia kuehniella* Zell. Females of *Tetranychus telarius* (L.) (*urticae* Koch) were killed by topical application of 0·1 mmg. Diazinon per gm. body weight in acetone to the back, as compared with 0·2 mmg. for parathion. The compound was also toxic to eggs of *E. kuehniella* and *T. telarius*. The persistence of effectiveness varies with the formulation and the substratum and is about 10–14 days (rather longer than for parathion) on leaves and fruits sprayed with the normal concentration of 2 lb. per 100 gals. and longer on inert surfaces.

In tests on stomach action, larvae of *Amathes* (*Agrotis*) *c-nigrum* (L.) were killed by feeding from one side of lettuce leaves treated with Diazinon on the other side. Toxicity at low concentrations was somewhat less than for parathion, but superior to that of lead arsenate, DDT or γ BHC. The median lethal dose for *Aphis rumicis* L. by ingestion was 0·12 mmg. per gm. body weight and the dose giving complete mortality 0·18 mmg., as compared with 0·025 mmg. for 1-isopropyl-3-methyl-pyrazolyl(5) dimethyl carbamate (Isolan), a specific aphicide, which explains the slow effect of Diazinon on Aphids sometimes observed in the field. Penetration into plant cells was demonstrated in tests in which Diazinon killed *Phylloxera vitifoliae* (Fitch) (*vastatrix* Planch.) in galls on vine leaves, *Eriosoma lanuginosum* (Htg.) in its galls on elm, and larvae of *Lyonetia clerkella* (L.) in apple leaves. Treatment of the upper or lower surfaces of the leaves with 0·02 per cent. Diazinon in an emulsion gave complete mortality of the mobile stages of *T. telarius* on the other surface in 3–6 days and killed 100 and 89–91 per cent. of the resting stages and eggs, respectively, in 6 days. There was, however, no evidence of translocation or systemic action of Diazinon in tests on beans or apple. In one of these, several insecticides were tested against *Aphis pomi* Deg. on apple trees 6 ft. high by painting 2 cc. 20 per cent. emulsion on the base. Diazinon and schradan were both ineffective, whereas O,O-diethyl O-2-(ethylmercapto)ethyl thiophosphate, Pyrazoxon and Isolan gave complete mortality in 7, 10 and 7 days, respectively, and the last two gave complete protection against artificial reinfestation after 6 weeks.

Field tests were carried out in various parts of Switzerland with the 20 per cent. emulsifiable solution, which proved compatible with the usual fungicides and caused no scorching of plants or tainting of fruit. Lists are given of the pests against which good results were obtained; they included Aphids, Coccids, Psyllids, Diptera, sawflies, Lepidoptera, Coleoptera and Tetranychid mites on various plants and wireworms and Melolonthid larvae in the soil. There was no effect on earthworms in treated soil. Preliminary observations indicated that Diazinon is less harmful than parathion to predators. It also proved toxic to various stored-product pests in the laboratory and to many arthropods of medical or hygienic importance [*cf. R.A.E.*, B **41** 198].

Viel (G.), Guérin (H.) & Mas (R.). **Toxicités relatives d'arséniates de cuivre purs vis-à-vis des larves de doryphores** (*Leptinotarsa decemlineata* **Say**).—*Parasitica* **5** no. 2 pp. 27–32, 1 graph, 5 refs. Gembloux, 1949.

Copper arsenates have been in use against *Leptinotarsa decemlineata* (Say) for some years, and comparative tests on their toxicity to the larvae were made in France using dicupric arsenate ($As_2O_5.2OCu.3OH_2$), pentacupric diarsenate ($2As_2O_5.5OCu.nOH_2$), tetracupric arsenate ($As_2O_5.4OCu.OH_2$) and copper sodium arsenate. The median lethal doses were determined by a method already noticed [*R.A.E.*, A **34** 83], and the order of increasing toxicity was found to be pentacupric diarsenate, tetracupric arsenate, copper sodium arsenate and dicupric arsenate; the median lethal

dose for the latter was less than 9–10 mmg. arsenic (As) per gm. body weight. The toxicities of these compounds and that of technical calcium arsenate (27 per cent. As) were compared by rearing fourth-instar larvae on leaves bearing deposits equal to 3–4 mmg. As per sq. cm. and noting the increase in mortality with the quantity ingested. The copper arsenates showed the same order of toxicity as before, pentacupric diarsenate failing to give complete mortality, and calcium arsenate was found to be less toxic than dicupric arsenate and more so than copper sodium arsenate. It is concluded that dicupric arsenate is at least as toxic as pure tricalcium arsenate [**30** 467] and technical calcium arsenate and greatly superior to acid lead arsenate.

Raucourt (M.) & Ventura (E). **Influence de la température sur l'efficacité des insecticides de contact.**—*Parasitica* **5** no. 2 pp. 33–38, 1 graph, 5 refs. Gembloux, 1949.

In the experiments described, which were carried out in the Ardennes district of France in 1948, a known amount of insecticide was applied to potato plants enclosed in cages and infested with larvae of *Leptinotarsa decemlineata* (Say), and mortality during the next four days was noted. The tests were made during three weekly periods in July in which the daily temperatures were unusually low, averaging 13·7, 16 and 20·6°C. [56·66, 60·8 and 69·08°F.], respectively, and this appeared to reduce the effectiveness of all three contact poisons used.

Dusts containing 0·25 per cent. rotenone applied at about 43 and 34 gm. rotenone per acre at temperatures of 16 and 20·6°C. gave only 34 and 36 per cent. mortality, respectively, whereas similar rates in 1937–39 gave 100 and 91 per cent., and a rotenone spray applied at about 22 gm. rotenone per acre when the temperature was 13·7°C. gave only 36·5 per cent. A dust of 4·5 per cent. DDT that killed 54 per cent. of the larvae in 18 hours and 100 per cent. in 42 hours in 1941 when applied at about 547 gm. DDT per acre at an average temperature of 25·8°C. [78·44°F.], killed only 30 and 82 per cent. after 32 and 80 hours, respectively, in 1948, when it was applied at 672 gm. DDT per acre at an average of 16°C. Five days after treatment, more larvae were released in the plot; the average temperature had risen to 21·4°C. [70·52°F.], and all were killed in 80 hours. A spray containing 4·5 per cent. DDT applied in 1941 at about 168 gm. DDT per acre at a temperature of 25·8°C. killed 98 per cent. of the larvae in 18 hours and all of them in four days, whereas one containing 8 per cent. DDT applied at about 173 gm. DDT per acre at an average of 13·7°C. in 1948 killed only 46 per cent. A dust of 0·5 per cent. parathion applied at about 70 gm. parathion per acre at an average temperature of 16°C. gave only 14·5 per cent. mortality in four days, mortality in the untreated control plots being 8 per cent.

Unlike these contact insecticides, lead arsenate, which was applied as a dust or a spray in all three periods and for which earlier data [*R.A.E.*, A **25** 462] were also available, was found to be little influenced by temperature. Earlier work showed that fluorine insecticides, notably barium fluosilicate, are not effective below certain temperatures; barium fluosilicate is both a stomach and a contact poison, and probably conforms to the general rule for contact insecticides.

Insecticides for use against *L. decemlineata* should be effective at quite low temperatures, and it is possible that some that are of value in south-western and central France may be useless in northern France or Belgium, especially since treatment may be necessary in May or June, when cold periods are not infrequent.

Coutin (R.). **Action comparée de divers insecticides sur les adultes de la cécidomyie des poirettes** (*Contarinia pyrivora* **Riley, Dip. Itonidae).**— *Parasitica* **5** no. 2 pp. 40–42, 3 refs. Gembloux, 1949.

In laboratory tests in France, sprays of 0·2 per cent. DDT, 0·1 per cent. BHC, 0·02 per cent. parathion or sufficient lead arsenate to give 0·2 per cent. arsenic (As) were applied to pear twigs bearing flower buds suitable for infestation by *Contarinia pyrivora* (Ril.). The twigs were caged when dry, and about 30 adults of the Cecidomyiid were introduced into each cage. Parathion gave complete and DDT almost complete mortality in 24 hours, BHC gave complete mortality in 36 hours, and dissection of the buds showed that all three prevented oviposition; under the conditions of the experiment, BHC could have exerted a fumigant effect. Lead arsenate failed to give complete mortality, but appeared to reduce oviposition. These results confirm the value of DDT applied prior to spring oviposition and indicate the usefulness of parathion, subject to further tests in the field.

Kirby (A. H. M.) & Gambrill (R. G.). **The Use of some newer Insecticides for the Control of Apple Sawfly,** *Hoplocampa testudinea* **(Klug).**— *J. hort. Sci.* **28** no. 3 pp. 163–169, 18 refs. London, 1953.

In further tests of organic insecticides for the control of *Hoplocampa testudinea* (Klug) on apple in Kent [*cf. R.A.E.*, A **40** 276], emulsion sprays containing 0·2 per cent. diacetone alcohol, 0·02 per cent. MB320 (cyclohexylamine dodecyl sulphate) and 0·0125 per cent. Aerosol OT (dioctyl sodium sulphosuccinate) with 0·02, 0·005 or 0·00125 per cent. parathion were applied in 1949 on 10th May, when 80 per cent. of the petals had fallen, and the lowest concentration of parathion also on 19th May, when hatching reached its peak. All sprays contained 1 per cent. lime-sulphur, and control trees received this only. The four treatments reduced the percentage of fallen and picked fruits attacked from 50·6 to 2·5, 12·9, 23·9 and 16·4, respectively, on Worcester Pearmain, and from 30·4 to 3·8, 9·5, 21 and 6 on Cox's Orange Pippin. Increasing the concentration of parathion in the petal-fall applications significantly increased control in all but one instance.

In 1950, nicotine was compared on Worcester Pearmain with BHC, chlordane, DDT, aldrin, dieldrin, toxaphene and parathion in petal-fall sprays applied on 17th–18th May. Parathion was formulated with diacetone alcohol and a non-ionic emulsifier of the ethylene-oxide condensate type, and the other insecticides with 0·05 per cent. MB320 and 0·01 per cent. Aerosol OT; diacetone alcohol was used at 0·5 per cent. with BHC, nicotine and the lower concentration of chlordane and at 1 per cent. with aldrin, dieldrin, DDT, toxaphene and the higher concentration of chlordane. All treatments gave highly significant control, the percentage reductions in fruits attacked being 98·4, 96·6 and 96·3 for DDT, toxaphene and chlordane at 0·1 per cent., 94·5 for 0·025 per cent. chlordane, 99·5, 98·9 and 94 for 0·05 per cent. dieldrin, aldrin and nicotine, 99·3 and 99·1 for 0·01 and 0·02 per cent. parathion and 98·9 and 93·6 for 0·01 and 0·005 per cent. γ BHC. The lower concentration of γ BHC was significantly less effective than the higher, though adequate for commercial control. Nicotine gave ample commercial control, despite rather low temperature at spraying time and a complete hatch of eggs.

In this and related tests, parathion was the only material to cause leaf damage, which was proportional to the concentration applied, but appeared of little significance. BHC, DDT, toxaphene, aldrin and dieldrin are compatible with lime-sulphur or wettable sulphur; parathion is known to

hydrolyse fairly rapidly in alkaline materials, but gave adequate control when applied with lime-sulphur in 1949. When sprays are applied at petal-fall, there is risk of injury to pollinating insects if blossom is present on cover crops or weeds; BHC and parathion are very injurious to bees, DDT is much safer, and toxaphene is the safest of the insecticides tested.

KIRBY (A. H. M.) & MCKINLAY (K. S.). **Some Factors affecting the Control of Apple Sawfly, *Hoplocampa testudinea* (Klug), by Nicotine and other Chemicals.**—*J. hort. Sci.* **28** no. 3 pp. 170–176, 13 refs. London, 1953.

Observations on the effect of nicotine and synthetic organic chemicals on the eggs and larvae of *Hoplocampa testudinea* (Klug) on apple were made in connection with spraying experiments carried out in Kent in 1946–48 [*cf. R.A.E.*, A **40** 276] and 1949–50 [*cf.* preceding abstract]. Daily examination of eggs in blossoms sprayed with parathion in 1949 and with nicotine, DDT, BHC, chlordane, toxaphene, aldrin, dieldrin and parathion in 1950 showed that these compounds did not act as ovicides but killed the newly hatched larvae. Nicotine appeared to act as a stomach poison [*cf.* **24** 686] and the other materials mainly or entirely by contact. BHC at 0·01 per cent. γ isomer and parathion at 0·02 per cent. caused very rapid mortality, whereas 0·05 per cent. nicotine permitted the larvae to survive for 24 hours or possibly more; toxaphene was the only other material that failed to cause rapid death. None of the treatments affected the rate of development of the eggs.

Eggs were deposited only on blooms that were fully open, and the relation between the blossoming period, the pollination period and the oviposition period of the sawfly determined whether eggs were laid in blossoms that would be shed or in those that would be fertilised and remain, and hence, whether larvae would fall before migration or remain to attack other fruitlets.

Nicotine gave effective control in 1947 and 1950, when the temperature on the day of application was 62 and 55°F., respectively, but not in 1946, when it was 60°F., and it is therefore concluded that the temperature on the day of spraying does not affect control by nicotine. Records of maximum temperatures between the dates of spraying and hatching each year showed that the temperature remained below 60°F. for seven days after spraying in 1946 only, and it appears that a cool period after spraying may delay hatching beyond the period during which the nicotine persists; sharp falls in temperature four days after spraying in 1947 and seven days after it in 1950 did not seem to delay hatching. Low temperatures late in May, after hatching had begun, might prolong the hatching period and so extend the time between spraying and the end of hatching and therefore the period over which an insecticide should persist. With the chlorinated hydrocarbons, this persistence should be possible however long the period might prove. Rainfall after the spray had dried did not appear to reduce the effectiveness of nicotine.

HELSON (G. A. H.). **The Transmission of Witches' Broom Virus Disease of Lucerne by the Common Brown Leafhopper, *Orosius argentatus* (Evans).**—*Aust. J. sci. Res.* (B) **4** no. 2 pp. 115–124, 5 pls., 2 graphs, 17 refs. Melbourne, 1951.

Investigations were made in 1947–48 on the insect vectors of the witches' broom disease of lucerne, which is prevalent throughout inland areas of Queensland, New South Wales, Victoria, and South Australia and also

occurs in north-western Australia [*R.A.E.*, A **24** 786]. In a survey in which collections of insects from infected lucerne were made at three-monthly intervals at eight places in New South Wales and at weekly intervals at one in the Australian Capital Territory, the possible virus vectors obtained were Jassids, and, in smaller numbers, Aphids and thrips. Ten Jassid species occurred commonly at all the places, and *Orosius* (*Thamnotettix*) *argentatus* (Evans) was one of the most numerous; it was most abundant during spring and early summer, whereas the others predominated during summer and autumn, and was the only one known to transmit virus diseases [*cf.* **31** 137; **32** 66]. In the laboratory, it failed to breed on lucerne, tomato or tobacco and died if fed exclusively on these plants; in lucerne fields, however, other food-plants are usually present. Examples collected from infected lucerne transmitted the disease to healthy *Datura stramonium*, from which it was transmitted by grafting to tobacco. Others from a virus-free stock reared in the laboratory that were allowed to feed on an infected lucerne plant in a greenhouse transmitted it to lucerne, sugar-beet, tomato, *D. stramonium*, *Erodium cicutarium*, *Hypochoeris radicata* and *Vinca rosea*, but symptoms, which appeared after only 35 days on tomato, did not appear on lucerne for nearly seven months. In all the plants, the symptoms comprised severe stunting, proliferation of axillary shoots, and the production of green flowers. The symptoms on tomato, sugar-beet, *D. stramonium* and *E. cicutarium* closely resembled those of the big-bud virus disease of tomato [**32** 65], and since *O. argentatus* transmits both, it is suggested that the two diseases may be caused by the same or closely related strains of virus. In the Capital Territory, populations of *O. argentatus* were high on lucerne until the end of December, and the incidence of big-bud on tomato increased rapidly in the middle of February following swarming of the Jassids at the end of January. A study of the literature and personal communications relating to virus diseases characterised by greening and proliferation show that a group of very similar diseases occurs over an area extending from Europe through Asia to Australia and the west coast of the United States [*cf.* **29** 542; **34** 74; **39** 61; **41** 245, etc.].

Day (M. F.) & McKinnon (A.). **A Study of some Aspects of the Feeding of the Jassid** *Orosius*.—*Aust. J. sci. Res.* (B) **4** no. 2 pp. 125–135, 4 figs., 13 refs. Melbourne, 1951.

In experiments on the transmission of the witches'-broom disease of lucerne by *Orosius argentatus* (Evans) in Australia [*cf.* preceding abstract], transmission was somewhat irregular, and since a similar irregularity had been reported in work with other Jassids [*R.A.E.*, A **28** 300], tests were made to determine whether variations in feeding might be the cause and whether feeding was modified by routine procedures in handling. The method adopted was to confine the Jassids in cages on the leaves of young beet plants that had been left for 24 hours with their roots in a culture solution containing tracer doses of sodium dihydrogen phosphate prepared with radioactive phosphorus (P^{32}) and were transferred to a normal culture solution prior to infestation, or to feed them on a solution of sugars incorporating the radioactive material.

The following is largely the authors' summary of the results. *O. argentatus* ingested P^{32} incorporated into the plant, and excreted approximately 65 per cent. of the amount ingested within 30 minutes after feeding had begun. The total amount ingested increased directly with the feeding period during an experiment lasting three days. There was considerable variation in uptake between individual Jassids, but the differences were usually insufficient to account for the observed differences in ability to transmit the

virus. No evidence of transmission of P^{32} to another plant was obtained. Anaesthesia by carbon dioxide had little or no effect on subsequent feeding. Starvation for about 30 minutes before feeding slightly increased the amount ingested in a 30-minute period. The pH and the sugar concentration of the artificial diet did not significantly alter the amount ingested [*cf.* **25** 288].

Hill (A. V.) & Allan (F. E.). **Yellow Dwarf of Tobacco in Australia. III. Occurrence and Effect of agronomic Practices.**—*J. Coun. sci. industr. Res. Aust.* **15** no. 1 pp. 13–25, 2 figs., 8 refs. Melbourne, 1942.

Hill (A. V.). **IV. Some Host Plants of the Virus.**—*Aust. J. agric. Res.* **1** no. 2 pp. 141–143, 1 pl., 3 refs. Melbourne, 1950. **V. Transmission by *Orosius argentatus* (Evans) to some alternative Host Plants.**—*T.c.* pp. 144–147, 1 pl., 3 refs.

These three papers form parts of a series dealing with the yellow dwarf virus disease of tobacco transmitted by *Orosius* (*Thamnotettix*) *argentatus* (Evans) in Australia [*cf. R.A.E.*, A **30** 279]. The first of them contains no information on the vector, and the investigations described in it showed that various agricultural practices had little or no influence on the percentage infection, which varied chiefly with district and season.

The second contains an account of attempts to discover alternative host plants of the virus. It was known to occur naturally in four wild species of *Nicotiana* and was readily transmitted by grafting to tomato and several wild solanaceous plants. Most of these plants are summer annuals, however, and not important as a source of infection of tobacco in spring; furthermore, none is a preferred food-plant of *O. argentatus* [*cf.* **31** 137], though it breeds on some of them. Natural infection was observed in *Datura stramonium*, *D. tatula* and tomato in widely separated districts remote from tobacco-growing areas, and field-collected *O. argentatus* transmitted the virus to tobacco, tomato and *D. stramonium*. The Jassid was present on plants of many species near a tobacco field in Victoria with a high percentage of infection; nymphs and adults were numerous on *Cryptostemma calendulaceum*, *Erodium cicutarium* and *Medicago hispida* (*denticulata*), and both readily transmitted the disease to tobacco and *D. stramonium* when transferred from these plants to them. These weeds appeared to be the main breeding plants for *O. argentatus* during winter and spring. The virus was also transmitted by adults collected from *Bursaria spinosa*, white clover (*Trifolium repens*), lucerne, mixed weeds and ornamental plants, to which they had probably migrated as their breeding plants died out with the onset of summer. In preliminary experiments, nymphs and adults bred in cages on *E. cicutarium*, *C. calendulaceum*, *M. hispida* and beet from a stock derived from field-collected infective adults, kept from early summer until the following spring on these four plants and *D. stramonium*, transmitted the virus to tobacco.

The third paper comprises an account of an attempt to discover the alternative host plants of the virus from which tobacco becomes infected in early spring. Batches of *O. argentatus* reared on infected *D. stramonium* were allowed to feed on plants of 23 species for a week, and were then replaced by virus-free Jassids, which, after feeding, were transferred to healthy plants of *D. stramonium* or *D. tatula*, and scions from the latter were later grafted to healthy tobacco plants. Transmission was obtained from plants of 15 species. *C. calendulaceum*, *M. hispida*, *E. cicutarium*, *E. cygnorum* and *Malva parviflora* were the most likely to serve as reservoirs

of the virus from autumn to spring, and most of these are common throughout the areas where the disease is most serious. Plants capable of carrying the virus over the summer included *D. stramonium*, *D. tatula*, aster (*Callistephus chinensis*), *Brassica adpressa*, *Sonchus oleraceus* and *Silybum marianum*; the perennials, *Modiola caroliniana*, white clover and lucerne, and the biennial, *Hypochoeris radicata*, could harbour it throughout the year. None of these plants developed visible symptoms except *C. chinensis*, *D. stramonium* and *D. tatula*. In view of the wide range of alternative host plants of the virus, their occurrence in tobacco-growing areas and the virtually continuous succession provided by them, control of the disease by their elimination appears impracticable.

Powning (R. F.). **The Compatibility of DDT with Nicotine and alkaline Diluents in agricultural Dusts.**—*Aust. J. agric. Res.* **1** no. 2 pp. 178–181, 2 graphs, 4 refs. Melbourne, 1950.

Combined dusts of DDT and nicotine sulphate applied against *Plutella maculipennis* (Curt.) and *Brevicoryne brassicae* (L.) on cabbage in field experiments in Australia already described [*R.A.E.*, A **38** 167] showed a marked reduction in toxicity to the larvae of *Plutella* when the diluent was calcium hydroxide, and it has been suggested [**34** 157] that there may be a reaction between nicotine and DDT in agricultural formulations. The effects of alkaline diluents and nicotine sulphate on DDT in dust mixtures during storage was accordingly investigated in the laboratory. Dusts containing 1 per cent. p,p′DDT in pyrophyllite, calcium carbonate, magnesium carbonate, magnesium oxide, barium hydroxide, or calcium hydroxide, which were the diluents used in the field alone or with 6 per cent. nicotine sulphate were analysed for DDT content immediately after preparation and after storage for up to eight weeks in air-tight tins at room temperature. At the end of this time, pyrophyllite, calcium carbonate and magnesium carbonate had caused very little reduction in DDT content, barium hydroxide had reduced it by about 40 per cent., and magnesium oxide by 95 per cent.; calcium hydroxide completely decomposed the DDT in a fortnight. Decomposition was slightly more pronounced in dusts containing nicotine sulphate, except when the diluent was pyrophyllite. Although barium hydroxide is more alkaline than calcium hydroxide, dusts diluted with it were more effective in the field and showed less reduction in DDT content in the laboratory; it reacts rapidly with atmospheric carbon dioxide to form barium carbonate, however, which, by analogy with calcium carbonate, would not cause rapid decomposition of DDT. It is concluded that the alkaline diluents were responsible for most of the decomposition of DDT, and that dusts of DDT and nicotine sulphate in pyrophyllite, calcium carbonate or magnesium carbonate are sufficiently stable to control cabbage pests and can be stored for at least two months prior to use.

May (A. W. S.). **Jassid Resistance of the Cotton Plant.**—*Qd J. agric. Sci.* **8** no. 4 pp. 43–68, 10 figs., 24 refs. Brisbane, 1951.

Since the use of resistant varieties of cotton appears to be the only practicable measure against *Austroasca terrae-reginae* (Paoli) (*Empoasca maculata* Evans) in Queensland [*R.A.E.*, A **39** 260], various entomological aspects of the problem of raising them were investigated during 1941–45. Observations on some 20 varieties of cotton showed that injury to the terminal shoots by the Jassid could, irrespective of variety, be classified into five grades of increasing severity, which are described, and these were

found to be related to the nymphal populations on these shoots, though the populations associated with the various grades gradually decreased during the season. The susceptibility of a variety was measured at different levels of infestation during three seasons by estimating the numbers of plants uninjured and showing each of the five successive grades of injury, and a plant resistance index was calculated for each variety on each sampling date by assigning grade numbers from 6 to 1, respectively, to the six categories distinguished, multiplying the number of shoots in each category by its respective grade number, and dividing the sum of these products by the total number of shoots sampled. The index varies from 1 to 6, and a high value indicates considerable resistance. In this way, marked varietal differences in susceptibility were shown to exist. In 1942–43, Jassid numbers decreased rapidly after the end of March, and whereas the indices of the more resistant varieties then increased or remained almost stationary, those of the susceptible ones declined. In the next two years, Jassid numbers were low, all index values were high, and there was little varietal difference. It is concluded that the indices are comparable only when based on records made on the same day at the same level of infestation and under the same cultural conditions. There was an inverse correlation between mean nymphal population and resistance index.

Resistance to Jassid attack has been shown to be due to inhibition of oviposition, and this is probably associated with the hairiness of the leaves [*cf.* **26** 261]. The type and density of the hairs on the lower surface of the mid-rib, where most of the eggs are deposited, are representative of the general condition [*cf.* **37** 218, etc.] and were accordingly investigated for each variety and correlated with its resistance index. Resistant varieties were found to have a long, dense cover of simple unbranched and long stellate hairs along the entire length of the mid-rib: some plants appear hairy but the mid-rib is relatively bare in the region of the nectary, and oviposition may occur on these when populations are high. The density of the hairs on the mid-rib for a distance of $\frac{1}{4}$ in. below the nectary provides a criterion for a rough classification of cotton varieties in broad groups of resistance, and this can be used in years when Jassid populations are too low for the plant resistance index to be reliable. Only plants with a uniformly long, dense hair cover over the entire length of the mid-rib should be selected for breeding purposes.

Observations on the occurrence of other cotton pests, which are reported in an appendix, showed that *Aphis gossypii* Glov. was more abundant on the resistant than on the susceptible varieties, and this may result from a restriction of the movements of its parasites and predators by the hairs. *Thrips tabaci* Lind. occurred commonly on hairy plants, though never in large numbers. The incidence of larger insects did not seem to be affected.

Brimblecombe (A. R.). **The Prevention of Borer Attacks on Hoop Pine Logs.**—*Qd J. agric. Sci.* **8** no. 4 pp. 69–105, 13 figs., 13 refs. Brisbane, 1951.

It is often impossible in rain-forests in south-eastern Queensland to move logs of hoop pine (*Araucaria cunninghami*) for some time after felling owing to wet weather or other local factors, and, during this period, they are subject to serious attack by timber beetles. Since the damage not only results in monetary loss, but also limits the uses of the timber, natural resources of which are nearing exhaustion, investigations on methods of protection by means of insecticides were begun in 1939. The species responsible for damage during the first few weeks after felling are the Platypodids, *Platypus froggatti* (Samps.), *P. australis* Chap., *P. semigranosus*

(Samps.), *P. subgranosus* Schedl and *Crossotarsus omnivorus* (Lea), and the Scolytids, *Xyleborus perforans* (Woll.) and *X. eucalypticus* Schedl, and characters differentiating them are given. *P. froggatti*, which is the most destructive, is restricted to hoop pine and is dominant where felling operations are in progress. The others are polyphagous and are dominant in virgin forest. All seven are strongly and positively chemotropic; cold and drought are both unfavourable, but attack may be heavy during periods of frequent rain in late summer and early autumn. Under suitable conditions, the logs are attacked on the day of felling. The adults construct branching tunnels that mostly run across the grain of the wood and extend deep into the log. Breeding in virgin areas is confined to decadent trees, suppressed branches and the sites of injuries; in felled areas, it is favoured by damage caused to standing trees by felling operations.

Experiments on the protection of logs likely to be left in the forest during wet weather were carried out in a felled and an unfelled area. The treatments tested were sprays of creosote, alone or combined with diluents or other toxic materials, and various other insecticides or repellents, including proprietary preparations; they were applied within two days of felling. All the sprays gave some protection, but those containing creosote were significantly superior to the others; the addition of other materials to the creosote sprays did not improve the results and in some cases impaired them. An emulsion of 1 gal. creosote, 8 oz. soft soap and 2 gals. water and creosote diluted 1 : 2 in kerosene, both used at a rate of about 1 gal. per 130 sq. ft. log surface, gave economic protection, but the former requires heat for its preparation and is therefore less suitable for forest use. Creosote was equally effective when used alone at the same rate as in these mixtures and in a prolonged test gave virtually complete protection for ten weeks when used at 1 gal. per 140 sq. ft. Bands of creosote round the logs at intervals of a foot did not protect the intervening surface, and the effectiveness of creosote as a complete cover therefore seems to be due to some change induced by it in the attractants in the wood.

Following the investigations, spraying with the creosote emulsion was adopted as a routine measure, and infestation was brought within economic limits. When the results became known, creosote was also used for the treatment of logs to be exported from New Guinea, and reduced infestation, which had previously been very heavy, to negligible proportions. It has also been found effective for the protection of hardwood logs against borers in rain-forests in northern New South Wales.

Lower (H. F.). **The Vegetable Jassid (*Austroasca viridigrisea* Paoli) in South Australia.**—*J. Dep. Agric. S. Aust.* **55** no. 2 pp. 64–68, 4 figs., 1 ref. Adelaide, 1951.

Austroasca viridigrisea (Paoli) [*cf. R.A.E.*, A **41** 228, etc.] is the most injurious of the Jassids that attack potato and tomato in South Australia and appears to be increasing in importance there. The adult is briefly described, the distribution of the species in Australia is reviewed [*cf. loc. cit.*], and an account of its life-history is given. It has been recorded from five districts in South Australia, and probably occurs wherever there is sufficient water to support its wild or cultivated food-plants. It is injurious from about October until March, has 4–5 generations a year, and varies considerably in numbers, sometimes becoming exceedingly common under warm, humid conditions. In March 1951, a potato crop at Athelstone was entirely destroyed by it, and the Jassids then migrated to neighbouring crops of lucerne and celery, which were saved only by cold, wet weather in

early April. Although potato and tomato are preferred, quite heavy infestations occur on cucurbits, beans, celery, lucerne and many weeds. The adults overwinter on lucerne and weeds, feeding but little, and eradication of the weeds is a useful control measure. If numbers become sufficiently great, crops should be treated with DDT as a 2 per cent. dust or a 0·1 per cent. spray.

Cabbage White Butterfly Parasites.—*J. Dep. Agric. S. Aust.* **55** no. 2 p. 68, 1 fig. Adelaide, 1951.

The introduced Braconid, *Apanteles rubecula* Marsh., was released against the cabbage white butterfly [*Pieris rapae* (L.)] at three places in South Australia between November 1950 and February 1951 [*cf. R.A.E.*, A **33** 322], and was becoming well established at the time of writing, despite a scarcity of host larvae and the presence of DDT residues. At one place, where dusts were not applied, the parasite increased rapidly enough to control *P. rapae*, but populations of the cabbage moth [*Plutella maculipennis* (Curt.)] and the cabbage Aphid [*Brevicoryne brassicae* (L.)] increased considerably. Other parasites of *P. rapae* already established in the State are *Pteromalus puparum* (L.), which attacks the pupae and affords considerable control, and one, thought to be *Apanteles glomeratus* (L.), of which earlier releases were made at one place [*cf.* **36** 215–216].

Laird (M.). **Insects collected from Aircraft arriving in New Zealand from Abroad.**—*Zool. Publ. Vict. Univ. N.Z.* no. 11, 30 pp., 53 refs. Wellington, N.Z., 1951.

The first paragraph of the following is virtually the author's summary.

The searching of 246 aircraft of seven military and civilian types on their arrival in New Zealand revealed that 88 (36 per cent.) had insect stowaways. A total of 548 insects collected included representatives of 56 families and ten orders, and nine spiders were also discovered. House-flies (*Musca domestica* L.) comprised more than a third of the total catch, 190 of these being collected on 46 separate occasions. Other insects of health significance included 29 blowflies (in 19 aircraft), 28 mosquitos (in 16 aircraft), 14 cockroaches (in 7 aircraft), and 2 fleas (in 1 aircraft). Actual or potential economic pests included numerous beetles, wasps, flies and moths. Among these were species already established in, and native to, New Zealand, a fact suggesting that insects might be exported from as well as imported into it. Records are given of the carriage of adult insects and the eggs and larvae of moths on the exterior of aircraft fuselages [*cf. R.A.E.*, A **39** 122]. Aircraft and airport insect control are discussed, with particular reference to measures enforced at Whenuapai Airport by the Medical Branch of the Royal New Zealand Air Force, on behalf of the New Zealand Health Department.

All aircraft arriving at Whenuapai Airport from overseas are boarded by an orderly, who sprays them throughout by means of an aerosol "bomb". The doors and windows of the aircraft then remain closed for five minutes, to ensure that the aerosol mist is not dispersed prematurely, before disembarkation and unloading takes place. Before boarding the aircraft, the orderly directs spray into the wheel cavities, and following disembarkation he also sprays any external baggage compartments and inspects the exterior of the fuselage to see if any insect nests or egg masses are present. In addition, he thoroughly searches the aircraft for insect remains, which are forwarded to Air Department for examination.

Cottier (W.). **Aphids of New Zealand.**—*Bull. N.Z. Dep. sci. industr. Res.* no. 106, 10 × 6¼ ins., xi + 382 pp., 98 figs., 10 pp. refs. Wellington, N.Z., 1953. Price £2 2*s*.

The Aphids dealt with in this monograph belong to the families Aphididae and Eriosomatidae, according to the classification adopted by Börner in 1930, and the book is in three parts. The first contains descriptions of the general morphology of the immature and adult forms of Aphids, the types of life-cycles, and the damage caused by their feeding, with brief surveys of the virus diseases transmitted by Aphids in New Zealand, work on the protection of potato seed crops from infection, and the control measures employed against Aphids. The second part comprises a history of the classification of Aphids, a study of variation in five species, and a systematic list of the 59 species recognised in New Zealand. Five of these are new, and a new genus is erected for one of them. Keys to the genera and species, descriptions of the genera and of the various forms of each species, and information on their food-plants, local distribution and synonymy are included. The last part comprises a list of plants showing the Aphids that attack them, and a selected bibliography.

Morrison (L. G.). **Apple Leaf-curling Midge, a new Pest in New Zealand.**—*FAO Plant Prot. Bull.* **1** no. 8 pp. 115–116, 1 fig. Rome, 1953.

The introduction of *Dasyneura mali* (Kieff.) into New Zealand on apple stocks and its subsequent spread there have already been noticed from a shorter account [*R.A.E.*, A **41** 287]. The infestations that resulted in apple orchards were not heavy enough to cause stunting. The measures adopted in attempts at eradication comprised treating the soil with naphthalene or DDT, spraying the foliage with parathion or with 50 per cent. wettable DDT at 1 lb. per 100 gals., and dipping nursery stock from which the soil had been shaken in red-oil emulsion and replanting it in an uninfested area, but only the last was successful. Foliage sprays of 2 lb. 50 per cent. wettable DDT per 100 gals., which have given satisfactory control in the United State [*cf.* **39** 349], were subsequently applied, but at the time of writing *D. mali* was still spreading, despite treatment at three-weekly intervals.

Outbreaks and New Records.—*FAO Plant Prot. Bull.* **1** no. 8 pp. 121–123. Rome, 1953.

W. J. Hall reports (p. 121) that the onion leaf-miner, *Phytobia* (*Dizygomyza*) *cepae* (Her.), which was recently recorded in Singapore [*R.A.E.*, A **41** 384], has since been discovered in Johore.

The U.S. Bureau of Entomology and Plant Quarantine announces (p. 122) that the pear psylla, *Psylla pyricola* Först., was found in California for the first time in May 1953 and that *Trialeurodes ruborum* (Ckll.), which was reported from the same State for the first time in March 1953, has since been found to be rather widespread in central California. The two counties infested by *P. pyricola* are separated from the commercial pear-growing districts by an extensive mountainous area from which pear is virtually absent. *T. ruborum* attacks blackberry, other species of *Rubus* and *Fragaria* sp., and was hitherto known only from the south-eastern United States.

Martin (Henri). **Observations on the Mediterranean Fruit Fly on *Citrus* in Tripolitania (Libya) in 1952–53.**—*FAO Plant Prot. Bull.* **1** no. 9 pp. 132–136. Rome, 1953.

Ceratitis capitata (Wied.) is probably the most injurious pest of fruit in North Africa, especially in coastal and irrigated areas of high humidity, but whereas infestation is always serious on peach, pear and apricot, its intensity and importance on *Citrus* vary with variety and season [*cf.* *R.A.E.*, A **30** 21; **41** 324]. Microscopic examination of *Citrus* fruits punctured by ovipositing females in Tripolitania, Libya, during 1952–53 showed that eggs had frequently not been laid in them and that although many of the eggs laid hatched, few of the larvae penetrated to the pulp. Larvae were not found in the pulp of lemons, but were rather numerous in mandarin oranges and pomelos. Unripe and slightly ripe *Citrus* fruits less frequently contained eggs or living larvae than ripe fruits. When grapefruits and oranges of three varieties showing punctures were examined in the laboratory one week after harvest, few larvae, and no living ones, were found in oranges of one variety that were collected in early August, but there were rather more larvae, though few living ones, in the others, which were all collected between 28th October and 28th November. Further observations on punctured fruits picked periodically during August–November and examined after being kept in the laboratory for a month showed that well-developed larvae were present in the pulp in 10–50 per cent. of grapefruits and pomelos, but in not more than 5·5 per cent. of the three varieties of oranges. Some varietal differences were noted. Most *Citrus* fruits are harvested by the end of February, though some late oranges and grapefruits remain till the end of April or the beginning of May, but in 1953 adults of *Ceratitis* died out at the beginning of January and were still absent at the end of April. Fruits on weak trees and on the south side of the tree are the most susceptible to attack.

A survey of the main *Citrus*-growing areas of Tripolitania between mid-December and the beginning of January, after the main flight was over, confirmed that attack varies with district and variety. Orchards in the interior and in certain areas on the eastern coast were almost free from attack. Grapefruits were very lightly infested up to the beginning of December, after which attack was heavy. Navel oranges were always heavily attacked, though the percentages punctured on one estate in Algeria between November 1949 and mid-January 1950 was only 1·4.

The author emphasises the desirability of selecting the less susceptible areas and varieties in extending *Citrus* cultivation in Tripolitania, and points out the advantage to international trade of reducing import requirements for *Citrus* fruits to an assurance of competent inspection, since the risk of introducing *Ceratitis* with punctured fruits varies with the place of origin, variety and season.

Ghabn (Abd El-Aziz Aly El-Sayed). **Studies on the Biology and Control of *Epilachna chrysomelina* F., in Egypt (Coleoptera-Coccinellidae).**—*Bull. Soc. Fouad Ier Ent.* **35** pp. 77–106, 1 col. pl., 3 graphs, 13 refs. Cairo, 1951.

With the exception of *Prodenia litura* (F.), *Epilachna chrysomelina* (F.) is the most important pest of cucurbits in Egypt, and, in view of recent considerable increases in the area under these crops and the favourable conditions provided for the Coccinellid in the main districts concerned, especially in the north, detailed studies on its bionomics and control were

carried out. Its food-plants, in order of decreasing importance, are watermelon, melon, vegetable marrow and cucumber.

The bionomics of *E. chrysomelina*, the egg, larva and adult of which are described, were studied in the laboratory, where five generations were reared in six months by a technique that is described. The ratio of males to females was about 3:4. The average and maximum periods for which adults of these generations survived varied from about 18 and 53 days at 28°C. [82·4°F.] to about 25 and 74 days at 20°C. [68°F.] for males and from about 37 and 123 days at 26·5°C. [79·7°F.] to 58 and 192 days at 17°C. [62·6°F.] for females. The preoviposition and oviposition periods averaged about 15 and 22 days, and the females laid an average of nearly 273 eggs each in about 13 batches, the numbers of eggs varying inversely with temperature. The mean temperatures at which development took place varied from 29 to 20·5°C. [84·2 to 68·9°F.], and the average durations of development from 31·8 to 43 days, the egg and pupal stages lasting about 3–5 days each. Mortality was highest in the egg stage and the first and fourth larval instars, averaging 66·1, 34 and 32 per cent., respectively, and was lowest (16·7 per cent.) in the third instar. An investigation of the effect of temperature and humidity on egg development and mortality showed that a temperature of 24°C. [75·2°F.] and a relative humidity of 90 per cent. provided the most favourable conditions, that the temperature limits are 30 and 18°C. [86 and 64·4°F.], and that mortality was higher at relative humidities above 90 than between 90 and 70 per cent., which is the lower limit for satisfactory development. There was considerable overlapping of the five generations, and most adults of the last did not pair or oviposit until the following spring. The adults appear to feed on wild cucurbits in desert areas during winter and return to cultivated crops in early spring; oviposition begins about the beginning of April. Both adults and larvae feed on the leaves and fruits, killing the plants in some cases, and young stems are sometimes girdled spirally, so that they break. No natural enemies were observed.

In experiments on control, dusts of 50 per cent. DDT diluted 1 : 9 in sulphur, 5 per cent. DDT, 50 per cent. BHC diluted 1 : 9 in sulphur, 5 per cent. BHC and a mixture of equal parts of calcium arsenate, lime and sulphur were applied to watermelon on 20th and 30th May 1948 at rates of about 17–22 lb. per acre. Most of the insects were in the egg stage on 20th May, and treatments on that date gave little control. A few days after the second application, the approximate mortality percentages were 90 for the calcium-arsenate mixture and 97–99 for the other materials; three weeks later, these percentages had fallen to 40 and 53–60, respectively. Calcium arsenate should not be applied within four weeks of harvest, and, to avoid toxic residues, hand-collection is preferable to the application of insecticides on marrow and cucumber, which are picked at frequent intervals. In a laboratory experiment in 1949, dusts of 2 per cent. parathion, 5 per cent. BHC and 5 per cent. DDT applied to the adults gave complete mortality in 10, 30 and 50 minutes, respectively.

Hafez (M.). **Notes on the Introduction and Biology of *Microplitis demolitor* Wilk. (Hymenoptera, Braconidae).**—*Bull. Soc. Fouad Ier Ent.* **35** pp. 107–121, 6 figs., 5 refs. Cairo, 1951.

A survey of the natural enemies of *Prodenia litura* (F.) was made in Queensland during 1938–41 with a view to introducing any of promise into Egypt against this moth. The parasites reared were the Ichneumonid, *Paniscus productus* Brullé, the Tachinids, *Tritaxys* sp. and *Actia nigritula*

Mall., and the Braconid, *Microplitis demolitor* Wlkn. [*cf. R.A.E.*, A **22** 353], and several consignments of the last two were sent to Egypt in 1939–41 [**41** 416]. An account of the introduction of *M. demolitor* and of studies on its bionomics is given. Nine shipments were received between November 1940 and October 1941. Of the 953 newly formed pupae dispatched, most gave rise to adults in transit, and many of these died, so that only 217 adults arrived alive. In the laboratory, larvae of *P. litura* and *Laphygma exigua* (Hb.) were successfully parasitised, but not those of *Agrotis ypsilon* (Hfn.), *Sesamia cretica* (Led.), or *Ephestia kuehniella* Zell. The progeny of laboratory-bred parasites at first showed a preponderance of males as a result of unwillingness to mate, but after isolating the pupae and confining the resulting adults in pairs the percentage of females in the progeny increased from 3·7 to 56·8, and this procedure was subsequently adopted. The egg and larval stages together and the pupal stage lasted 7–18 and 3–10 days, respectively, according to temperature. Adult males and females survived for averages of 19 and 23 days when provided with water and honey and kept at about 22°C. [71·6°F.], for 16 and 18 days when only water was provided and for 3 and 7 days without either food or water. *M. demolitor* overwinters as a last-instar larva or pupa. Only 10 per cent. of a number of newly formed cocoons placed in the field on 29th November 1941 gave rise to adults, and these emerged between 4th and 18th April 1942. Pupae stored at about 13°C. [55·4°F.] failed to give rise to adults at that temperature or, if the storage period exceeded three months, when returned to room temperature. There is no true diapause, since rise of temperature in winter at once accelerates development. Under laboratory conditions, there were 18–25 generations a year.

The eggs of *M. demolitor* are deposited immediately beneath the skin of the host. The larvae feed on the body fluids and fat-body, and only one completes its development in each host, which it leaves to pupate. *Prodenia* larvae were readily attacked in the first four instars, though the second and third are the most suitable, rarely in the fifth and never in the sixth; parasitised first-instar larvae usually died before the parasite larvae had completed their development, but older larvae survived for 2–8 days after the parasites had left them. *Prodenia* larvae attacked and fed on parasite larvae that had left their hosts, and parasite cocoons and pupae.

Mass production of *M. demolitor* was hindered by many factors, including difficulties in rearing suitable larvae of *P. litura* and *L. exigua* on a large scale, the long life-cycle of these hosts, superparasitism, and the labour involved in isolating the parasite pupae and in removing the parasite cocoons to forestall attack by host larvae. Over 6,000 adults that had paired in the laboratory were liberated at seven places between May 1941 and October 1942 in fields infested with appropriate stages of *P. litura* on various crops, including cotton, and *L. exigua* on leguminous crops, but no recoveries were made in subsequent extensive field collections. The failure of the parasites to become established is attributed to inadequacy of the liberations.

Priesner (H.). **Description of the Common Egyptian *Trogoderma* (Coleoptera: Dermestidae).**—*Bull. Soc. Fouad Ier Ent.* **35** pp. 133–135, 3 figs. Cairo, 1951.

The common species of *Trogoderma* in Egypt is here described from adults of both sexes as *T. afrum*, sp.n. It is a major pest of stored grain there and in the Anglo-Egyptian Sudan and has been misidentified in the past. Characters distinguishing it from other species of the genus are given.

Wagner (E.). **Neue Wanzenarten aus Aegypten (Hemiptera-Heteroptera).** [New Heteroptera from Egypt.]—*Bull. Soc. Fouad Ier Ent.* **35** pp. 141–144, 2 figs. Cairo, 1951.

One of the two Heteroptera described is the Anthocorid, *Cardiastethus pseudococci*, sp.n., which was found preying on *Saccharicoccus* (*Pseudococcus*) *sacchari* (Ckll.) on sugar-cane in Egypt in 1939.

Zaazou (H. T.). **The Effect of Age on the Host-selection Principle.**—*Bull. Soc. Fouad Ier Ent.* **35** pp. 167–174, 10 refs. Cairo, 1951.

In view of conflicting evidence [*R.A.E.*, A **15** 398; **16** 529; **26** 1; **40** 21] as to the validity of Hopkins' host-selection principle [**10** 83], the effects of age on the selection of food by insects was investigated in the laboratory, using *Bruchus obtectus* Say, *B. maculatus* F. and *B. chinensis* L. as test insects. The method adopted was to place different kinds of seeds in alternate compartments in a darkened petri dish divided into eight by means of cardboard strips and distribute newly emerged Bruchids evenly over it, or to place two kinds of seeds in opposite compartments and Bruchids in two others, each of which was separated from the seeds by an empty compartment. The eggs were counted, fresh seeds provided and the beetles redistributed after five days, and a further count was made after another five days. The preferred food of *B. obtectus* is pea bean, and when adults that had been reared on red kidney beans were offered red and white kidney beans, Black Valentine beans and pea beans, over 34 per cent. of the total number of eggs laid during the first five days were deposited on pea bean; during the last five days, the eggs were more evenly distributed among the different seeds, and most were laid on red kidney beans. A similar preference for pea bean was shown by adults of a strain reared for about two years on haricot beans and offered haricot beans, pea beans, and red and white kidney beans; when they were offered only pea beans and haricot beans, 79·8 per cent. of the eggs laid during the first five days were on pea beans. In both these tests, the eggs were more evenly distributed during the second five days, but haricot beans received fewest.

Cowpeas are the preferred food of *B. maculatus* and *B. chinensis*, and when adults of strains that had been reared on broad beans for about six months were offered cowpeas and broad beans alone or with the addition of string beans and peas, most eggs were laid on cowpeas throughout the two periods, though the preference was much less marked during the second.

It is concluded that the host-selection principle does not apply to these insects and that the chemical sense responsible for host selection is not constant throughout life but becomes weaker with age.

Ferrière (C.). **Chalcidiens orientaux introduits en Egypte (Hymenoptera).** —*Bull. Soc. Fouad Ier Ent.* **35** pp. 187–191, 2 figs., 6 refs. Cairo, 1951.

Several Hymenopterous parasites were introduced into Egypt from Java for the control of *Phenacoccus hirsutus* Green, and the most effective, *Leptomastix phenacocci* Comp., has become established [*R.A.E.*, A **27** 506]. They included the three dealt with in this paper which are probably hyperparasitic on *P. hirsutus*. Two of these are described as the Encyrtids, *Achrysopophagus javanicus* and *A. annulatus*, spp.n. The other is the Aphelinid, *Eriaporus aphelinoides* (Comp.), which Compere described as the only species of the new genus *Eurymyiocnema* [**36** 109], but is closely

related to *Eriaporus laticeps* Wtstn. [5 456], described as a new genus and species of Miscogasterid. The author agrees with an unpublished opinion of Ghesquière that the two are congeneric and gives characters differentiating them. *E. aphelinoides* is probably parasitic on *L. phenacocci*.

Kamal (M.). **Biological Control Projects in Egypt, with a List of introduced Parasites and Predators.**—*Bull. Soc. Fouad Ier Ent.* **35** pp. 205–220, 7 refs. Cairo, 1951.

The author briefly describes the development of work on the biological control of insect pests in Egypt, summarises the projects undertaken and the results achieved, and gives a chronological list of the numerous parasites and predators introduced between 1890 and 1942, showing their hosts and countries of origin and whether or not they became established.

Kamal (M.). **The Biological Control of the Cotton Leaf-worm** (*Prodenia litura* **F.) in Egypt.**—*Bull. Soc. Fouad Ier Ent.* **35** pp. 221–270, 1 col. pl., 1 graph. Cairo, 1951.

Since neither hand-collection of the eggs nor the application of arsenicals, which are the usual measures employed against *Prodenia litura* (F.) on cotton in Egypt, is entirely satisfactory, the natural enemies of the moth were investigated with a view to attempting biological control. A survey over six years showed that natural enemies gave about 32 per cent. control in summer and 75 per cent. of the winter generation, and that, though unable to control heavy infestations, they maintain normal ones at a level at which no artificial measures are necessary. The predators, which are the more important, especially during June–August, when attack by *Prodenia* is heaviest, comprised the Coccinellids, *Coccinella undecimpunctata* L. (which was parasitised by *Tetrastichus coccinellae* Kurdj. and by *Perilitus* (*Dinocampus*) *coccinellae* (Schr.), itself parasitised by *Eupteromalus* sp.), *Cydonia vicina nilotica* Muls., *C. v. subsignata* Pic, *Scymnus interruptus* (Goeze) and *S. syriacus* Marseul: the Staphylinid, *Paederus alfierii* Koch, which was parasitised by *Perilitus* sp.; the Carabid, *Calosoma maderae chlorostictum* Dej.; the Anthocorids, *Orius albidipennis* (Reut.) and *O. laevigatus* (Fieb.); *Chrysopa vulgaris* Schneider, which was parasitised by *Telenomus* sp. and *Tetrastichus pubescens* (Nees); the Ascalaphid, *Helicomitus festivus* (Ramb.); and various spiders. The most important native parasites of the larvae were *Tachina larvarum* (L.), which was parasitised by *Dirhinus giffardii* Silv., and *Actia palpalis* Will.* Others comprised the Ichneumonids, *Eulimneria xanthostoma* (Grav.) and *Barylypa humeralis* (Brauns), and the Braconids, *Zele chlorophthalma* (Nees) and *Z. nigricornis* (Wlk.). The Pteromalid, *Conomorium eremita* (Först.), and *Trichogramma evanescens* Westw. parasitised the pupae and eggs, respectively. Accounts are given of the bionomics of each, based on laboratory studies, together with observations on their effectiveness in the field. Their failure to give permanent control is attributed to winter temperatures too low for most of them though sometimes mild enough for *P. litura* to remain active, their slow increase in spring, the low reproductive capacity of most of them in comparison with the host, and attack by parasites. An attempt to increase control by the mass rearing and periodic release of *Coccinella undecim-*

* The name *Actia palpalis* Will. has not been traced at this Institute. *A. aegyptia* (Villen.) has been recorded as parasitising *Prodenia litura* in Egypt [*cf. R.A.E.*, A **22** 674].—*Ed.*

punctata and *T. evanescens* was not successful, and it was therefore decided to introduce species that give effective control elsewhere.

Six consignments of puparia of the Tachinid, *Actia nigritula* Mall., were dispatched from Queensland during 1939–41 [*cf. R.A.E.*, A **41** 413]. Mortality in transit and in the laboratory in Egypt was high, but 150 survivors were liberated, mostly in coastal areas. The Braconid, *Microplitis demolitor* Wlkn., was also introduced from Australia, where it gives up to 50 per cent. control; it was reared in the laboratory and liberated in batches of up to 20 in widely scattered cotton fields in the northern Delta [*cf. loc. cit.*]. Recoveries of *M. demolitor* were made at the liberation sites or from more distant fields within a few weeks or months of the date of release, but not subsequently, though a closely related unidentified species of *Microplitis* was reared during July 1941 and 1944 from very young larvae of *P. litura* in two districts where liberations had been made. *M. demolitor* is regarded as the more promising of the two introduced parasites, since it attacks young host larvae, which are gregarious and so may provide opportunities for total parasitism, and produces two generations in the time occupied by one of the host.

The Scelionid egg parasite, *Telenomus nawaii* Ashm., was introduced from Fiji in 1936 [**26** 212], and a stock was reared in the laboratory by a technique described. Larvae of *Laphygma exigua* (Hb.) and *Agrotis ypsilon* (Hfn.) were used as hosts when *P. litura* was not available. Some seven million adults were liberated during the summers of 1938–40. At average daily temperatures of 29–32°C. [84·2–89·6°F.] and a relative humidity of 45–50 per cent., the life-cycle lasted 9–11 days. Most of the eggs in each egg-mass attacked were parasitised, but many of the parasitised eggs were destroyed by predators. In October 1940, a consignment of *T. spodopterae* Dodd was received from Java, where it is an effective parasite of *P. litura* on tobacco, and a stock was raised in the laboratory by the use of the technique and hosts employed for *T. nawaii*. During 1942–43, some four million adults of both species were liberated in fields with varying ecological conditions. Up to 80 per cent. parasitism was obtained when they were placed directly on the egg-masses, but not more than 3 per cent. when they were merely released in the fields. It is concluded that the two species are effective when liberated directly on the egg-masses and that for the best results, they should be reared continuously in the laboratory and liberated each summer. *L. exigua* and *A. ypsilon* are quite common in winter, when eggs of *P. litura* are scarce, and are suitable alternative hosts.

De Lotto (G.). **Osservazioni sulla biologia della *Trilocha ficicola* Westw. (Lepidoptera, Bombycidae).** [Observations on the Biology of *T. ficicola*.]—*Riv. Agric. subtrop.* **44** no. 4–6 pp. 98–102, 3 figs., 2 refs. Florence, 1950.

Trilocha ficicola Westw., all stages of which are described, damages fig and other species of *Ficus* in Eritrea. In studies on its bionomics, begun in 1944 at Asmara, the adults lived for 8–10 days and the females laid 300–400 eggs each in groups of about 50–250, usually on the undersides of the leaves. The larvae hatched in 14–18 days, fed on the leaves for 40–50 days, and pupated among dry leaves on the ground or in cracks in walls, etc. The adults emerged after 18–23 days, and there may thus be 3–4 generations a year. Considerable control is afforded by birds and parasites. The latter comprised *Telenomus* sp., which attacked up to 92 per cent. of the eggs, with an average of 26·8 per cent., *Apanteles* sp., which parasitised up to 50–60 per cent. of the larvae, with an average of 37 per cent., *Hemiteles* sp. and *Paurophatnus* sp., which together parasitised about 3 per

cent. of the larvae, and *Goryphus* sp., which emerged from 18 per cent. of the prepupae. Good results were obtained against the larvae with suspension sprays of 0·05 per cent. DDT. Some control is given by placing rolled-up sacking or rags in the forks of the branches, removing them every 15–20 days and killing the larvae that have entered them to pupate.

DEL VALLE (R. G.). **Lagarta invasora** (*Laphygma exempta*, **Wlk.**). [The Armyworm (*L. exempta*).]—*Gaz. Agric.* **2** no. 9 pp. 37–41, 3 figs., 2 refs. Lourenço Marques, 1950.

Laphygma exempta (Wlk.) and *L. exigua* (Hb.) are injurious in Mozambique, both attacking cereals such as maize and rice and various wild grasses, and the latter also beans, groundnuts and lucerne. The larvae of the two species are described and the characters differentiating them are pointed out. *L. exempta* is the more important, since it occurs in outbreak numbers more frequently and causes graver damage. Its life-cycle varies with the temperature and lasts about a month under normal conditions, the larval stage lasting 15–20 days and the pupal stage about a week. Outbreaks occur without warning and disappear just as suddenly when the larvae enter the soil to pupate. There are several generations a year. Reference is made to studies in South Africa on the occurrence of phases in this armyworm [*R.A.E.*, A **37** 170, etc.]. The outbreaks usually occur in January–March, depending on temperature and rainfall, but are delayed until April or May in some years. In Quelimane in 1949, as a consequence of late rains, large numbers of the pest developed on wild grasses in April and May and then attacked rice. This was well advanced in growth, and instead of recovering from the attack, as usually happens when infestation occurs early in the season, it was completely destroyed. The control measures recommended resemble those noticed from South Africa [**30** 610]. Places in which outbreaks are likely to arise, such as patches of grasses that remain green throughout most of the year, should be inspected from January onwards and sprays of lead arsenate, sodium arsenite or DDT applied to form protective barriers 2–3 yards wide round infested areas. The areas themselves should then be sprayed or, if they are of considerable extent, be treated with poison baits.

COATON (W. G. H.). **Termites and their Control in cultivated Areas in South Africa.**—*Bull. Dep. Agric. S. Afr.* no. 305, 28 pp., 13 figs., 6 refs. Pretoria [?1951].

This bulletin contains information on the nesting and feeding habits and the control of termites that damage cultivated plants in South Africa. The most important are the harvester termites that nest below the soil surface, of which the 16 species, subspecies and forms hitherto recorded from the Union and South-West Africa [*cf. R.A.E.*, A **38** 135, etc.] are now known to be referable only to the two variable species, *Hodotermes mossambicus* (Hagen) and *Microhodotermes (H.) viator* (Latr.), and fungus growers of the genera *Macrotermes* and *Odontotermes*. Both types can be eradicated, the former by means of poison baits [**38** 136] and the latter by toxic smokes [**39** 417, etc.]. Damage by small fungus growers of the genera *Microtermes*, *Allodontermes* and *Ancistrotermes* and by species of *Microcerotermes*, which construct carton nests immediately below the surface of the soil and damage plants by hollowing out the roots and subsequently the stems and branches, is of relatively little importance. Neither group can be eradicated, as they are repelled by poison baits and their galleries

are too small for the introduction of toxic smokes, but damage can be reduced by providing a plentiful supply of plant débris on and in the soil, maintaining crop plants in good vigour and applying repellents, such as DDT or calcium arsenate, to lawns and newly set plants to protect them until they become well established.

LOCHNER (E. H. W.). **The Control of the Red Spider** (*Tetranychus bimaculatus* **Harvey). A Description of the Red Spider and of Experiments carried out with certain of the newer insecticidal Materials as Miticides and Ovicides under controlled Temperature and Humidity Conditions.**—*Sci. Bull. Dep. Agric. S. Afr.* no. 306, 29 pp., 3 figs., 2 refs. Pretoria, 1951.

None of the measures hitherto recommended for the control of *Tetranychus bimaculatus* Harvey in South Africa [*cf. R.A.E.*, A **37** 58] is entirely satisfactory, and in view of its importance as a pest of fruits, flowers and vegetables and the increase of populations in orchards due to destruction of its natural enemies by DDT applied against *Cydia pomonella* (L.), several recently developed acaricides were tested against it. A detailed account of the work is given, together with descriptions of the various stages of the mite and a brief account of its bionomics and the damage caused.

In laboratory tests, the materials were applied as dusts and sprays, by methods already noticed [**37** 177], to portions of infested leaves in petri dishes against the adults and nymphs and as dusts and by a dipping method against the eggs. The tests were carried out at a relative humidity of 70–75 per cent. and temperatures of 60–85°F. Dusts were applied at rates equivalent to 1·6–20 lb. per acre, and sprays in general at 6–7 gals. per acre, though sometimes half this rate was employed.

Of the dusts applied against the nymphs and adults, 1 and 2 per cent. parathion and 1 per cent. dinex (dicyclohexylamine) were the most effective; complete mortality was given by all three in 48 hours at 1·6 lb., and by the parathion dusts in 24 hours at 6·6 lb. A dust of 5 per cent. β,β-dimethylacrylicacid-N-methylanilide gave complete mortality in 24 hours at 20 lb. per acre, but its effectiveness rapidly decreased at rates below 10 lb. It acted more rapidly than either parathion or dinex (dicyclohexylamine). DDT, BHC and toxaphene were rather ineffective. Of the sprays, 40 per cent. TEPP (tetraethyl pyrophosphate) diluted 1 : 2,000 was the only one to give complete mortality in 48 hours at economic concentrations, though toxaphene destroyed all the mites in 24 hours at high ones. HETP (hexaethyl tetraphosphate) diluted 1 : 1,000 or, combined with azobenzene, 1 : 160, was also effective. Dinex (dicyclohexylamine) diluted 1 : 200 was less effective as a spray than as a dust, and a mixture containing DDT and water-soluble nicotine compounds was of little value.

In tests on the eggs, 2 per cent. parathion was the most effective of the dusts and, at the highest temperature, gave complete mortality, at 6·6 lb. per acre. A dust of 10 per cent. BHC also gave good results at high temperatures, but only at a high rate of application (16·6 lb. per acre). Parathion and dinex (dicyclohexylamine) at 1 per cent. were less effective than 2 per cent. parathion, and toxaphene and DDT were useless. Parathion, unlike dinex (dicyclohexylamine), did not inhibit the development of the eggs, but killed the nymphs either immediately before or immediately after hatching. Of the sprays tested, the best was the mixture of HETP and azobenzene, which gave complete control at all temperatures even when diluted to 1 : 640. A spray of 15 per cent. wettable parathion was also satisfactory at various concentrations, and dinex (dicyclohexylamine) was fairly effective at 80–85°F. but disappointing at lower temperatures. TEPP,

HETP alone or in miscible oil, and the mixture of DDT and nicotine compounds were all rather unsatisfactory, and BHC and DDT in wettable powders were of no value. Toxaphene and DDT at a concentration of 50 per cent. in miscible oil gave good results, but these are attributed to the oil, which coated the egg and excluded oxygen. In all the laboratory tests, the effectiveness of the materials was increased at high temperatures, but limited tests indicated that relative humidity had little influence on toxicity.

In further tests, dusts of parathion, DDT, BHC, toxaphene and chlordane and sprays of parathion and HETP alone or with azobenzene were applied to infested plants in greenhouses. The HETP sprays were the most effective; one application of HETP alone at 1 : 600 gave complete mortality in 48 hours, as did two of the mixture at 1 : 160 with an interval of five days. Two applications of 25 per cent. wettable parathion at 0·03 per cent., a week apart, gave complete mortality, but dusts of 1 and 2 per cent. parathion at 20–25 lb. per acre were less effective. The parathion spray caused slight injury to beans and cucurbits, and the 2 per cent. dust caused fairly serious damage to tomato. Three applications of a dust of 1 per cent. dinex (dicyclohexylamine) at 25–30 lb. per acre almost freed plants of several species from infestation, but injured some of them. Sprays of this material were less effective, and dusts of 5–10 per cent. DDT, BHC or toxaphene or 10 per cent. chlordane, all at 35–40 lb. per acre, were unsatisfactory.

Chatt (E. M.). **Cocoa. Cultivation—Processing—Analysis.**—$8\frac{3}{4} \times 5\frac{3}{4}$ ins., xiv + [1 +] 302 pp., 32 figs., refs. New York & London, Interscience Publ. Ltd., 1953. Price $8.50.

This comprehensive survey of the history, botany, cultivation and processing of cacao throughout the world includes a chapter (pp. 57–78) on pests and diseases. The pests are almost all insects and comprise species that attack the living plant or the stored beans. Notes are given on their bionomics, distribution and control and on the importance of the damage caused. The diseases include the West African swollen shoot and the Trinidad red mottle, and information is given on the causal viruses and on the mealybugs known to transmit them in the Gold Coast and Trinidad.

Parker (H. L.), Berry (P. A.) & Silveira Guido (A.). **Host-parasite and Parasite-host Lists of Insects reared in the South American Parasite Laboratory during the Period 1940–1946.**—*Rev. Asoc. Ing. agron.* no. 92 repr. 101 pp. Montevideo, 1953.

These lists are based on material collected in South America in 1940–46 during a search for beneficial insects suitable for introduction into the United States against agricultural pests. The first shows the host insects with their parasites and predators and brief locality records, and the second the parasites and predators with the insects they attack.

Cortés (R.) & Campos (L.). **Acción de insecticidas sistémicos sobre estados larvarios de conchuela negra del olivo** (*Saissetia oleae* **Bern.**). [Action of Systemic Insecticides on nymphal Stages of *S. oleae*.]—*Agric. téc.* **12** no. 1 pp. 5–10, 1 fig., 8 refs. Santiago, Chile, 1952. (With a Summary in English.)

In the experiments described, which were carried out in the greenhouse in Chile between November 1951 and February 1952, a commercial emulsion concentrate containing 66 per cent. schradan was tested against second-stage

nymphs of *Saissetia oleae* (Bern.) on orange seedlings 16 ins. high. The mortality percentages after 30 days were about 51–56 and 95–98 when the plants were sprayed with 0·1 and 0·5 per cent. dilutions of the concentrate, respectively, at 10 cc. liquid per plant, and about 36–60 and 57–69 when they were watered with the same dilutions at 200 cc. per plant. Mortality in the controls was 18–22 per cent. No phytotoxic effects were observed.

Durán M. (L.). **Aspectos ecológicos de la biología del sanjuan verde *Hylamorpha elegans* (Burm.) y mención de las demás especies de escarabeidos perjudiciales en Cautín.** [Ecological Aspects of the Biology of *H. elegans* and Mention of other Species of Lamellicorns injurious in Cautín.]—*Agric. téc.* **12** no. 1 pp. 24–36, 4 figs., 5 refs. Santiago, Chile, 1952. (With a Summary in English.)

Lamellicorn larvae cause extensive damage to cereal and forage crops in southern Chile, and studies in the Province of Cautín in 1948–51 showed that the species mainly responsible are the Rutelids, *Hylamorpha elegans* (Burm.) and *Brachysternus prasinus* Guér., the Melolonthids, *Phytolaema herrmanni* Germain, *Sericoides germaini* D.T. and *Schizochelus breviventris* Philippi, and an unidentified Aclopid.

The distribution of *H. elegans* is discussed. The adults of this species feed on the leaves of *Nothofagus obliqua* [*cf. R.A.E.*, A **23** 361] and were observed in December 1947 on *Prunus avium*, which proved to be an acceptable food-plant in the laboratory. Observations on its bionomics showed that the newly emerged adults remain in the soil for 5–6 days before coming to the surface. The date of the first flight varied from mid-October to late November, and the adults were present until February or March. Larvae were found from mid-January until September. They remained at depths of 2–4 ins. and caused little damage until June–July, when they moved up very close to the surface and fed on plant roots, causing serious damage to cereals and many other plants. During cold weather in May 1949, larvae were found more than 8 ins. deep. Pupation occurred in cells in the soil at depths of 2–4 ins., and the pupal stage lasted 28 days. Since the larvae found were almost all of one size at any given time, it is concluded that the life-cycle is completed in a year. The number of larvae per sq. metre rarely exceeded 25 in 1948–50, though it was 376 in one locality in August 1949, and since it was reported to be about 200–300 in 1946–47 and also high in 1945–46, it is thought that there may be some cyclic progression in numbers, 1947 being a peak year. Density was little affected by plant associations but varied with the type of soil, being low in light sandy soils near rivers. Larvae of *P. herrmanni*, *Sericoides germaini* and occasionally *B. prasinus* were found in association with those of *H. elegans*.

Gonçalves (C. R.). **Males da carnaúba no Ceará e no Piauí.** [Pests of Carnauba in Ceará and Piauí.]—*Bol. fitossanit.* **3** (1946) no. 3–4 pp. 145–170, 34 figs., 16 refs. Rio de Janeiro [1950].

An account is given of observations on the pests and diseases of the palm, *Copernicia cerifera*, from the leaves of which carnauba wax is obtained, made during visits to Ceará and Piauí, in north-eastern Brazil, in September and October 1945. Of the insects found attacking the leaves, the larvae of *Brassolis sophorae* (L.), which were parasitised by *Spilochalcis nigrifrons* (Cam.), were the most important, and *Cerataphis lataniae* Boisd., *Aspidiotus destructor* Sign. and *Diaspis boisduvalii* Sign. caused some damage. *Sibine* sp., which also infested the leaves, causes considerable

discomfort to workers because of its spines and urticating hairs. The unopened leaves were damaged by larvae of *Coraliomela brunnea* (Thnb.) and *Castnia* sp., which bore in the terminal bud. *Castnia* is not widely distributed but has caused considerable damage in one region of Piauí since 1944, when it was first observed there. The larva and pupa are described. Two unidentified species of Coleoptera bored in the trunks, and the larvae of *Pachymerus nucleorum* (F.) fed on the seeds.

Gomes (J. G.) & Gonçalves (A. L.). **Generalidades sôbre o método de criação do *Trichogramma* na Estação Fitossanitária de S. Bento—D.D.S.V.** [General Information on the Rearing of *Trichogramma* at the Phytosanitary Station of São Bento—Division of Sanitary Plant Protection.]—*Bol. fitossanit.* **3** (1946) no. 3–4 pp. 171–184, 10 figs. Rio de Janeiro [1950].

Laboratory rearing of *Trichogramma minutum* Ril. on eggs of *Sitotroga cerealella* Ol. was begun at São Bento, Rio de Janeiro, in 1945 to provide parasites for release against *Leucinodes elegantalis* Gn. on tomato. The technique adopted, which is described, was similar to one already noticed [*R.A.E.*, A **19** 95], and it is stated that liberation by means of cards bearing eggs of the parasite was in progress.

Carneiro Ribeiro (J. H.). **Um ecoforídeo em folhas de mangueira (Lepidoptera, Tineoidea).** [An Oecophorid on the Leaves of Mango.] —*Agronomia* **10** no. 1–2 pp. 105–108, 4 figs. Rio de Janeiro, 1951.

Larvae of an Oecophorid identified as *Machimia crossota* (Wlsm.) were observed on mango in a suburb of Rio de Janeiro in 1950. They fed on the leaves by night, causing considerable damage, and rested by day in shelters consisting of two leaves webbed together. Pupation occurred in a cocoon spun on the underside of a leaf. The pupal stage lasted 21 days at 24°C. [75·2°F.] in the laboratory.

Andrade (A. C.) & Puzzi (D.). **Resultados preliminares de experiências para controlar o percevejo castanho em cana de açúcar.** [Preliminary Results of Experiments on the Control of *Scaptocoris castaneus* on Sugar-cane.]—*Biológico* **17** no. 3 pp. 44–49, 1 fig. São Paulo, 1951.

The Cydnid, *Scaptocoris castaneus* Perty, has recently caused considerable damage by attacking the roots of maize, cotton, rice and sugar-cane in São Paulo, and experiments were made in 1950–51 on its control on sugar-cane by dusts applied to the open furrows before the setts were planted. In the first series, begun in February 1950, in which the materials were applied alone or with fertiliser, a product containing 1 per cent. γ BHC did not affect rooting at 18 lb. per acre, but reduced it at 36 and 54 lb., mixture with the fertiliser not affecting the results. In the second, begun in March 1950, the BHC product at 18 lb. per acre and 10 per cent. toxaphene at 18 and 36 lb. per acre did not affect rooting, but the BHC product at 36 lb. and 10 per cent. DDT at 18 and 36 lb. reduced it. Counts of the insects on the roots in December 1950 and February 1951 showed that all treatments gave considerable reductions in the numbers, the most effective being BHC and toxaphene at 36 lb. on the first date and DDT and

toxaphene at 36 lb. on the second. Protection was adequate, however, only in the case of BHC at 36 lb. and toxaphene at either rate.

Araujo (R. L.). **Dados bionômicos de uma lagarta do cafeeiro** *Dalcera abrasa* **Herr.-Sch. 1854 (Lep., Dalceridae).** [Notes on the Bionomics of a Coffee Caterpillar, *D. abrasa*.]—*Biológico* **17** no. 3 pp. 55–57, 3 figs. São Paulo, 1951.

Descriptions are given of the egg, larva and pupa of *Dalcera abrasa* H.-S., larvae of which were found feeding on the leaves of coffee in São Paulo in 1947 and again in 1951. In observations on the bionomics of this Dalcerid, 70 larvae received in November 1947 were placed with coffee leaves in glass jars. Many died as a result of attack by Hymenopterous parasites and a fungus of the genus *Beauveria*, but 13 adult males and 8 females were obtained. One of three females that emerged on 22nd–24th December and were kept separately with males was fertilised two days after emergence, and it laid 152, 241, 58 and 32 eggs on the following four days, scattered throughout the cage and on the coffee leaves in it. The larvae hatched in 8–9 days, but because of a further attack by *Beauveria*, only four gave rise to adults, total development lasting 119–165 days. The adult males and females from the original material survived for averages of 3·8 and 5·3 days, respectively. The larvae feed at first on the parenchyma of the leaves and then on the whole leaf, and spin their cocoons on leaves folded together and held by threads.

A infestação de ácaros nos cafezais. [Infestation by Mites in Coffee Plantations.]—*Biológico* **17** no. 7 p. 130. São Paulo, 1951.

Mites found injuring the leaves of coffee at various places in São Paulo in 1950–51 were identified as *Paratetranychus ununguis* (Jac.) and *Brevipalpus* (*Tenuipalpus*) *phoenicis* Geijskes. The first was the more abundant and caused bronzing of the upper leaf surfaces. Unidentified predacious mites appeared to hold them in check, but records from the literature indicate that outbreaks sometimes occur during dry periods.

Giannotti (O.) & Lepage (H. S.). **Nota preliminar sôbre o efeito de alguns inseticidas modernos sôbre duas pragas do pessegueiro** (*Ceratitis capitata* **e** *Grapholita molesta*). [A preliminary Note on the Effect of modern Insecticides on two Pests of Peach (*Ceratitis capitata* and *Cydia molesta*).]—*Biológico* **17** no. 9 pp. 166–168, 11 refs. São Paulo, 1951. **Errata.**—*T.c.* no. 10 p. 178.

In a test on the control of *Ceratitis capitata* (Wied.) and *Cydia* (*Grapholita*) *molesta* (Busck) on peach in São Paulo, suspension sprays of insecticides, all with 2 per cent. sugar, were applied to groups of four trees seven times at intervals of about ten days between 10th October and 2nd December, and the fruits picked a fortnight later. Both fallen and harvested fruits were kept in cages for emergence of insects, and the numbers of *Ceratitis* and *Cydia* obtained per 100 fruits were 51·4 and 1·2 for 0·5 per cent. BHC (containing 6 per cent. γ isomer), 70·4 and 0·5 for 0·25 per cent. DDT, 48·9 and 2·9 for 0·2 per cent. toxaphene and 39·2 and 0 for 0·025 per cent. parathion, as compared with 134·6 and 18·6 for no treatment.

Giannotti (O.) & Puzzi (D.). **Pulverização de laranjeiras com inseticidas modernos e seus efeitos sôbre a população de duas cochonilhas.** [Spraying Orange with modern Insecticides and its Effects on the Populations of two Coccids.]—*Biológico* **17** no. 10 pp. 171–177, 16 refs. São Paulo, 1951.

The authors review the literature on the causes of the increase in population of certain Coccids on *Citrus* after treatment with various materials [*cf. R.A.E.*, A **38** 333; **39** 342, etc.], and describe experiments in São Paulo in 1950–51 in which wettable-powder sprays were applied to orange trees infested by *Chrysomphalus ficus* Ashm. and *Lepidosaphes beckii* (Newm.). In 1950, ten applications were made between January and August, and subsequent counts of the two Coccids on sample twigs showed that the numbers were 311 for 0·02 per cent. parathion, 1,543 for 0·175 per cent. DDT, 637 for 0·35 per cent. of a powder containing 6 per cent. γ BHC, 405 for 0·14 per cent. toxaphene and 178 for no treatment. In 1951, five applications were made between April and June, and the corresponding figures were 69, 1,421, 121, 151 and 111, respectively. Examination of the results for the two species separately in 1951 indicated that none of the sprays had much effect on *L. beckii*, and that *C. ficus* was mainly responsible for the great increase following spraying with DDT. There was 10·3 per cent. parasitism of the scales on trees sprayed with DDT in 1951 as compared with 30·2 per cent. on trees receiving the other treatments.

Franco do Amaral (S.). **Ação residual de inseticidas em solo turfoso—resultados de um ensaio de campo.** [Residual Action of Insecticides in turfy Soil—the Results of a Field Experiment.]—*Biológico* **17** no. 12 pp. 209–214, 2 figs., 1 ref. São Paulo, 1951.

In an experiment in late 1948 on the control of insects attacking rice in São Paulo, the soil of plots in a rice field was dusted with 5 per cent. DDT or 0·5 per cent. parathion or a BHC dust containing 0·45 per cent. γ isomer, all at 0·75 oz. per sq. yard, the young plants were dusted with 0·6 per cent. BHC, 5 per cent. DDT or 0·5 per cent. parathion in talc, or both treatments were applied. Inconclusive results were obtained in 1948, but all the treatments with BHC or DDT gave considerable protection against wireworms attacking the next crop a year later. They had lost most of their effectiveness by December 1950.

Giannotti (O.) & Lepage (H. S.). **Pulverizaçoes concentradas com diversos inseticidas para o contrôle de algumas pragas do algodoeiro.** [Concentrated Sprays of various Insecticides for the Control of some Pests of Cotton.]—*Biológico* **18** no. 5 pp. 73–82, 2 figs., 6 refs. São Paulo, 1952.

The authors review work in the United States on the use of concentrated sprays against pests of cotton and give an account of experiments with such treatments in São Paulo in 1951–52. The sprays were prepared from emulsion concentrates and were applied at about 4 gals. per acre on 4th December (when infestation was first observed), 18th and 28th December, 31st January, 15th February and 6th March, the amounts of active ingredient in oz. per acre being about 28 for toxaphene, 26 for chlordane, 3·5 for aldrin, 8 for a mixture of DDT and aldrin (1 : 1), and 6 for γ BHC.

Aphis gossypii Glov. increased throughout the season on untreated plants, and counts 19 days after the third application showed that the numbers of Aphids per leaf were then 289 for no treatment, 347 for the mixture of

aldrin and DDT, 154 for chlordane, 158 for aldrin alone, 55 for toxaphene and 32·1 for γ BHC. Counts of *Thrips* sp. were made on 6th February and showed that the percentage reductions in infestation as compared with no treatment were 81·7, 76·1, 60, 85 and 62·8 for toxaphene, chlordane, aldrin, the mixture of aldrin and DDT, and γ BHC, respectively. Infestation by *Rhinacloa* sp., *Lygus* sp. and *Horcias* sp. did not occur until the end of February, later than usual, and counts made on 12th March showed that the percentage reductions in the numbers of the immature stages were 97·3, 84·3, 92·1, 100 and 73·7, respectively. The corresponding reductions in *Empoasca* sp. on the same date were 74·4, 15·2, 21·2, 87·6 and 40. Infestation by *Alabama argillacea* (Hb.) was light, and the larvae were effectively controlled by all the insecticides. Mites appeared at the end of January, and observations after the last applications showed that they were most numerous on the plots sprayed with chlordane and the mixture of aldrin and DDT and least so on those sprayed with γ BHC or aldrin alone. The percentage increase in yield was 60·3 for toxaphene, 44·7 for chlordane, 29·4 for aldrin, 30·3 for aldrin and DDT, and 60·7 for γ BHC.

McKelvey (J. J.), Smith (A. C.), Guevara C. (J.) & Cortés I. (A.). **Biología y control de los picudos del género *Apion* que atacan al frijol en México.** [The Biology and Control of the Weevils of the Genus *Apion* that attack Beans in Mexico.]—*Foll. téc. Ofic. Estud. esp. Secret. Agric. Méx.* no. 8, 42 pp., 14 figs., 18 refs. Mexico, D.F., 1951. (With a Summary in English.)

The most important of the species of *Apion* that attack beans on the high plateaux of Mexico [*cf. R.A.E.*, A **37** 188] has been found to be *A. godmani* Wagner; *A. aurichalceum* Wagner is associated with it. Beans on the coastal plain of Veracruz are attacked by *A. germanum* Sharp and *A. A. perpilosum* Wagner. The distribution of *A. godmani* in 1946–49 and the local intensity of infestation by it in 1947–49 are shown on maps. It is more numerous than *A. aurichalceum* and also much more injurious, for though it deposits fewer eggs per pod, it lays them in or near several or all of the rudimentary seeds and the larvae feed singly, whereas *A. aurichalceum* lays about 35 eggs near one seed, frequently at the distal end of the pod, and the larvae feed gregariously. The life-history of *A. godmani* is described [*cf.* **37** 189]; attempts in 1948–50 to discover where the adults overwintered were unsuccessful.

In further experiments in 1947–49 on the effect of planting date on infestation by *A. godmani* [*cf.* **37** 189], beans were sown 10–11 times at fortnightly intervals between April and September and counts were made once or twice a week. The first larvae were found between 5th and 16th July, and the average numbers of insects per pod in the most severely infested fields ranged from less than one for beans sown in April to 2·6–3·3 for those sown in June, after which they again declined. Four varieties of beans showed promise of resistance to infestation.

In experiments on the control of *A. godmani*, sprays of parathion, DDT, methoxy-DDT and toxaphene applied four times at weekly intervals at 1·5 lb. toxicant per 100 gals. were the most effective treatments tested in 1948, and reduced the numbers of insects per 100 pods from 72·5 to 1, 3, 9·9 and 17, respectively. In 1949, treatment was begun when the beans were in flower, and 0·5 lb. parathion, 1·5 lb. DDT or methoxy-DDT, 7 lb. cryolite and 5 lb. rotenone per 100 gals. reduced the number from 103·8 to 1·2, 10·8, 16·3, 32 and 40·7, respectively. Dusts of 1 per cent. parathion or 3 per cent. DDT, methoxy-DDT or chlordane applied three times at weekly intervals reduced it from 66 to 1·6, 8·4, 8·4 and 13·8. Some of the

larvae were parasitised by an unidentified Braconid of the genus *Triaspis*, which was present in very small numbers in July, but became more numerous towards the end of the season.

McGregor (E. A.) & Ortega C. (A.). **Una nueva araña roja de México, *Paratetranychus mexicanus* sp. nov. (Acarina, Tetranychidae).** [A new Red Spider in Mexico, *P. mexicanus*, sp. n.] [*In Spanish & English.*]—*Foll. téc. Ofic. Estud. esp. Secret. Agric. Méx.* no. 10, 7 pp., 5 figs. Mexico, D.F., 1953.

Maize was severely attacked by Tetranychids in the central plateau of Mexico in 1945. Mites in one of the collections made proved to belong to no known species and are here described from adults of both sexes as *Paratetranychus mexicanus*, sp.n. *P. mexicanus* closely resembles *P. modestus* (Banks), and characters are given differentiating both sexes of the two species. It is also recorded from Johnson grass [*Sorghum halepense*].

Insects.—*Yearb. U.S. Dep. Agric. 1952* xviii + 780 pp., 80 pls. (72 col.), text illus., refs. Washington, D.C., 1952. Price $2.50.

The yearbooks of the U.S. Department of Agriculture are each devoted to a different subject, and that of the present volume is economic entomology. The book contains 110 articles, by many contributors, and they are grouped in 21 sections, of which three deal with some general aspects of insect life and behaviour, the classification, identification, collection and preservation of insects, and ways in which insects are useful to man, one with the relations of insects to diseases of man, animals or plants, eight with the development, preparation, action, properties and uses of insecticides, methods and equipment for applying them, the hazards associated with their use and legislation relating to them, insect resistance to insecticides, fumigants and fumigation, quarantines, other methods of control, and the development and organisation of pest control in the United States, six with insects or mites that are injurious there to cotton, vegetable and field crops, fruit and forest trees, or ornamental plants, one with insects that are troublesome in houses, and one with some aspects of the relations of insects to wild life. A final section contains a bibliography, the addresses of advisory officials and organisations, conversion tables and equivalents, a summary of Federal plant regulatory legislation, and a list of approved names for pest control products. In addition, some 70 common pests are illustrated in colour and their bionomics and control summarised in a series of plates.

Summers (F. M.) & Baker (G. A.). **A Procedure for determining relative Densities of Brown Almond Mite Populations on Almond Trees.**—*Hilgardia* **21** no. 13 pp. 369–382, 1 fig., 5 refs. Berkeley, Cal., 1952.

Almond is commonly attacked by *Bryobia praetiosa* Koch in the Sacramento and San Joaquin Valleys of California. The population increases slowly to a maximum in late May or early June and then decreases rapidly with the onset of diapause in the eggs, whereas the two-spotted mite [*Tetranychus bimaculatus* Harvey] and the Pacific mite [*T. pacificus* McG.] become numerous later. In spite of this, the population density of *B. praetiosa* is not easy to estimate, owing to the habit of the mites of feeding on the leaves and resting and reproducing on the bark, only a small fraction of the total active population visiting the leaves at any one time.

Although the movement between leaves and wood may be rapid, the mites tend to remain localised, and dispersal from infested to uninfested areas is slow on mature trees. The mites congregate in large numbers on the rough bark of woody terminals and lateral stems at or near the bases of the leaf shoots on which they feed, and it was therefore considered that a short section of branch or twig removed from the tree after the leaf shoots have developed would bear both the actively feeding mites and those that normally feed on these shoots, and that the numbers of mites removed from both wood and leaves of small samples would serve as comparative population indices. By the technique evolved, twigs with 12–16 inches of mature wood are clipped from the outer foliage, and the mites are jarred from them on to sheets of paper, where they soon redistribute themselves. They are then gently crushed under a second sheet of paper, and the spots produced are counted, if necessary with the aid of a sampling template having five apertures of 1 sq. in. The shoots on the twigs are counted, and the numbers of mites per shoot per template recorded.

This procedure is useful for estimating the results of tests of control, and the results of one experiment are included to illustrate it. None of the treatments gave decisive control, but statistical analysis showed that plots of 4–5 similar trees of one variety carrying a fairly uniform infestation of mites are satisfactory units and that sampling 30 twigs from each plot is sufficient unless variations are unusual or the distinctions to be made very fine.

Maltais (J. B.) & Auclair (J. L.). **Occurrence of Amino Acids in the Honeydew of the Crescent-marked Lily Aphid, *Myzus circumflexus* (Buck.).**—*Canad. J. Zool.* **30** no. 4 pp. 191–193, 7 refs. Ottawa, 1952.

The following is the authors' summary. The honeydew of *Myzus circumflexus* (Buckt.) feeding on Katahdin potato contains 22 free amino acids and amides, which are given in their respective amounts. Carbohydrates constitute also an important portion of this product of digestion in Aphids. Analyses of amino compounds in honeydew may be of prime importance in the study of the causes of plant resistance to Aphids.

Jacobson (L. A.). **Effects of Starvation on Larvae of the Pale Western Cutworm, *Agrotis orthogonia* Morr. (Lepidoptera: Phalaenidae).**—*Canad. J. Zool.* **30** no. 4 pp. 194–200, 4 graphs, 5 refs. Ottawa, 1952.

One of the control measures recommended against *Agrotis orthogonia* Morr. in Canada is starvation of the first-instar larvae by clean cultivation [*R.A.E.*, A **35** 108]. Larvae in any instar may be subjected to starvation for various periods under field conditions, however, and the effects on larvae in all the six instars were accordingly investigated in the laboratory. The larvae were starved for varying periods at 10, 15, 20 or 25°C. [50, 59, 68 or 77°F.]. Mortality curves indicated variations in individual susceptibility or resistance to starvation, and most of the larvae starved in the sixth instar pupated. The time required for 50 per cent. mortality of the older larvae varied inversely with temperature and directly with size, and ranged from 9 days for third-instar larvae at 25°C. up to 38 days for fifth-instar examples at 15°C. The rate of mortality of newly hatched larvae was almost the same at all temperatures, whether the larvae were fed or not before being starved.

In a discussion of the application of these findings to control practice, the author points out that the recommended interval of 10–14 days between

clean cultivation and germination of the crop may be more than adequate to destroy the young larvae in warm weather and too short under cool conditions. The risk of jeopardising the crop by delayed sowing, however, renders control of older larvae by starvation not always practicable.

[Shapiro (I. D.).] Шапиро (И. Д.). **On the toxic Action of Hexachlorane on Insects through the Plant.** [*In Russian.*]—*Dokl. Akad. Nauk SSSR* (N.S.) **80** no. 3 pp. 481–484, 3 refs. Moscow, 1951.

BHC has been found in the Soviet Union to act as a systemic insecticide [*cf. R.A.E.*, A **41** 293], and it was shown in the experiments here described, which were carried out in the Province of Leningrad, to protect plants against attack even when applied at rates insufficient to give insect mortality. A dust containing 12 per cent. BHC was used as a seed dressing at rates affording about 1·8 lb. BHC per acre after sowing. When seeds of turnip and pea, treated with 50 and 1 per cent. of their weight of the dust, respectively, were sown in the laboratory, fleabeetles of the genus *Phyllotreta* that were released on the turnip shoots all died in 72 hours, but weevils of the genus *Sitona* that were released on the pea shoots were not affected. When the treated pea seeds were sown in the field, however, on 28th April, the percentage of plants damaged by the weevils by 7th June was only 55, and injury was usually slight, as compared with 100 per cent. of plants damaged, most of them severely, for no treatment, and the treated plants were much the more vigorous.

In an attempt to discover the cause of this, peas and vetch [*Vicia*] were sown in bottomless containers sunk into the soil, each container being divided by a glass plate into halves in one of which treated seeds and in the other untreated seeds were sown. When the plants had sprouted, ten were left in each half, the containers were caged with muslin and 80 weevils were introduced into each cage. Examination 10 and 29 days later showed that the percentages of plants destroyed were 15 and 25, respectively, for the peas and 10 and 30 for the vetch grown from treated seed and 100 in all cases for no treatment. It is concluded that the reduction in injury is due to a repellent effect of the plant tissues on the weevils and that an effective concentration in the plant tissues is maintained for a month.

[Édel'man (N.M.).] Эдельман (Н. М.). **Some Peculiarities of the physiological Reaction of the Acorn Weevil** (*Balaninus glandium* **Marsh.) to the Action of DDT, BHC and Dichloroethane.** [*In Russian.*]—*Dokl. Akad. Nauk SSSR* (N.S.) **81** no. 1 pp. 117–120, 1 graph, 2 refs. Moscow, 1951.

In further studies on ways of increasing the physiological reactions of insects to insecticides, larvae of *Curculio* (*Balaninus*) *glandium* Marsh. were exposed to dusts of 5 per cent. DDT, 12 per cent. BHC or a mixture of 2·5 per cent. DDT and 6 per cent. BHC by the technique previously adopted [*R.A.E.*, A **40** 221]. Treatment was followed by loss of weight, reductions in water and fat contents and an increase in oxygen consumption, all of which increased in severity for the insecticides in the order named. Larvae exposed twice showed the same reactions to a greater degree and also a fall in the coefficient of respiration, the insecticides causing 23, 25 and 30 per cent. mortality, respectively. Successive exposure to DDT and the mixture increased the percentage mortality to 40. The loss of fat is important, as the larvae do not feed after they have entered the soil, and thus become exhausted and unable to pupate. This action of DDT and BHC on larvae

that are not immediately killed should be taken into consideration in estimating their effectiveness.

Ethylene dichloride was tested in the laboratory on larvae in containers filled with soil and in the field by soil injection, the larvae being transferred to untreated soil after the desired exposure. Exposure in the laboratory to a dose of 9 oz. per sq. yard for 48 hours caused a great decrease in oxygen consumption and an increase in weight but no mortality in five days. These reactions subsequently became intensified, and the percentage mortality rose from 16·5 after ten days to 89·9 after 30. The oxygen consumption of the survivors was still only half the normal at the end of this time. The increase in weight was due to a rise in water content, the mechanism of which was not known, but which may have been partly responsible for death. Mortality would thus be greater in wet than in dry soil. Field tests with ethylene dichloride at 6 and 12 oz. per sq. yard gave similar results; mortality after 26 days averaged 91·1 per cent. for the lower dosage in July and 85 per cent. for the higher one in June and was greatest at depths of 4–6 ins. DDT and BHC were also most effective in July, when oxygen consumption was at its maximum and the fat content of the larvae reduced.

[Batiashvili (I. D.).] Батиашвили (И. Д.). **The regional Distribution of Pests of subtropical Fruit Crops on the Black Sea Coast.** [*In Russian.*] —*Dokl. vsesoyuz. Akad. sel.-khoz. Nauk Lenina* **18** no. 3 pp. 31–35. 2 refs. Moscow, 1953.

With a view to the recommendation of control measures against insects and mites that attack fruit trees in the Black Sea zone of the Soviet Union, the author divides this region into three subzones differing in the characteristics of their pest population and climate. Lists are given of the chief pests of fruit trees in each, and the limiting climatic factors are discussed. The first is a narrow strip of coast from Batum to Adler extending inland to an altitude of about 820 ft., and most of the pests concerned are susceptible to even slight frost. The second comprises the mountain slopes from Adzharia to Sochi and is characterised by thermophilous species. The third is the largest, consisting of extensive areas in Krasnodar, Abkhazia, Mingrelia and Imeretia, and the pests are cold-resistant. The Crimea and the region of Lenkoran are distinct zones, owing to the dryness of their climate, and are not considered.

[Evlakhova (A. A.).] Евлахова (А. А.). **The Application of the microbiological Method in the Control of the Noxious Little Tortoise.** [*In Russian.*]—*Dokl. vsesoyuz. Akad. sel.-khoz. Nauk Lenina* **18** no. 3 pp. 36–39, 2 figs. Moscow, 1953.

In continuation of work on the use of fungi against *Eurygaster integriceps* Put. in the Soviet Union [*cf. R.A.E.*, A **29**, 583], experiments were carried out in 1950 in the region of Krasnodar with a culture of *Aspergillus repens* isolated in 1948 from dead examples of *Locusta migratoria* (L.) in cages. The fungus was cultured on grain, hay or dead examples of *Eurygaster* by a simplified method and it proved effective in preliminary laboratory tests against both overwintered and newly emerged adults, giving up to 93·5 per cent. mortality in ten days. Spores and mycelium were observed in the salivary glands, intestines, air sacs and tracheae of dead bugs, which indicated that the fungus might have entered via the mouthparts or the spiracles. In field experiments, broadcasting a dust of the spores cultured on grain or hay at the base of infested wheat plants at the rate of about $\frac{1}{4}$ oz. per sq. yard in April–May gave an average of 57·5 per cent. mortality

of the overwintered bugs in 21–34 days, and this resulted in 33–47 per cent. reduction of the nymphal population as compared with untreated plots. In the second half of June, when nymphs and young adults were present, dusting with spores mixed with ground maize and spraying with a suspension made from fresh infected hay reduced the population per sq. metre from 34 to 16·8 and from 33·6 to 20·5, respectively, in 5–7 days, whereas no reduction occurred in the controls. The fungus was harmless to the wheat and retained its virulence in the field for up to 6–8 weeks. The temperature was favourable for fungus development during the tests, but the relative humidity was low, and better results might have been obtained at higher humidity. In preliminary experiments in August–September, in which forest litter containing a sparse population of hibernating bugs was treated with a preparation of the fungus on grain, 46·5 per cent. mortality resulted, which was 25·5 per cent. higher than in the controls. It is concluded that the method is promising, and further research is recommended.

[Semenov (A. E.).] Семенов (A. E.). **A combined Method of applying Hexachlorane Dust for the Control of the Onion Fly on Onion Seedlings.** [*In Russian.*]—*Dokl. vsesoyuz. Akad. sel.-khoz. Nauk Lenina* **18** no. 3 pp. 40–43, 1 fig. Moscow, 1953.

In the extreme north of the Soviet Union, *Hylemyia* (*Chortophila*) *antiqua* (Mg.) is a major pest of onion seedlings, so that their production had to be discontinued in many places and seedlings brought from further south. Experiments were therefore carried out in 1950–51 at Kondinsk to find effective methods of control. The adults leave their hibernation quarters rather late in spring, and mass oviposition begins in mid-June, when the seedlings have developed one true leaf. Owing to favourable weather in 1951 oviposition was intense, with an average of 880 eggs per plant. The great majority of the eggs were laid in the upper layer of soil but a few were deposited in cracks and under lumps of earth.

In 1950, dusting the growing seedlings up to four times with BHC or DDT failed to give sufficient protection, 15–29 per cent. of the plants being killed by the fly, as compared with 44 per cent. for no treatment. A combined method was therefore tested in 1951, in which 12 or 6 per cent. BHC dusts were introduced into the upper inch of soil between the rows on 10th June at the rate of 135 lb. per acre., and were also applied to the plants at rates of 9–13·5 lb. per acre, on 10th and 25th June. The results were very satisfactory for both dusts and showed that soil treatment with two applications to the seedlings resulted in 4–5 times as many uninjured plants as in the controls. Other treatments proved inferior.

[Gradojević (M.) & Nikolić (V.).] Градојевић (М.) и Николић (В.). **Protection of Fruit Trees and Grape Vine from Pests and Diseases.** [*In Serbian.*]—$9\frac{3}{4} \times 6\frac{3}{4}$ ins., 227 [+ 3] pp., 80 col. pls., 39 figs. Zagreb, Pol'oprivr. Nakl. Zavod, 1952.

Of the four parts of this book on the pests and diseases of fruit trees, berry fruits, nuts and vines in Yugoslavia, the first two deal with insects. The first (pp. 9–55) contains general notes on insects, followed by a survey of the orders and families that are of importance in fruit cultivation either as pests or as parasites or predators, with notes on their general morphological characters, and descriptions of the various types of injury caused. Information is given on the different methods of control available and on the preparation and uses of various insecticides. The second part (pp. 56–132)

deals with the individual species arranged systematically and contains information on their bionomics, the appearance of the different stages, the type of injury caused, food-plants and control, the more important pests being discussed at some length. A separate section is devoted to natural enemies. The other two parts are concerned with diseases and include references to insects that transmit viruses. In an appendix, the pests are listed by their popular names under the plants attacked.

Hierholzer (O.). **Ein einfaches Verfahren zur Erlangung gleich vitaler Versuchstiere.** [A simple Procedure for obtaining Test Insects of equal Vitality.]—*Anz. Schädlingsk.* **24** pt. 10 pp. 152–153, 2 figs. Berlin, 1951.

It sometimes happens that divergent results are obtained in parallel tests of insecticides in the laboratory, owing to variations in the vitality of the test insects, even though these are reared under similar conditions. The author describes a simple apparatus in which adults of *Calandra granaria* (L.) of similar vitality are selected by means of their negative phototropism. It consists essentially of a tray illuminated by a lamp at one end and having a detachable darkened collecting box at the other. The weevils are liberated at the lighted end and those that reach the box within a fixed time are used as test insects. The results obtained with insects selected in this way were far more uniform than those from examples selected at random.

Holz (W.). **Beobachtungen über den Flug von Frühjahrsfrostspannern in Obstanlagen.** [Observations on the Flight of Spring Geometrids in Orchards.]—*Anz. Schädlingsk.* **24** pt. 11 pp. 165–167, 3 figs., 4 refs. Berlin, 1951.

Since winter sprays of DNC or DNC and tar distillate have not given good protection against late attack by Geometrids of the winter moth group on fruit trees in north-western Germany of recent years, despite careful treatment, the possibility that part of the infestation might be due to species that emerge in spring was investigated in two apple orchards near Oldenburg in 1950–51. Adhesive bands were placed on the trees in October and examined every fortnight to ascertain the intensity of the flight of *Operophtera* (*Cheimatobia*) *brumata* (L.). The numbers taken, averaging 72 and 44 per tree, were considerably lower than in previous years. At the end of January, when the flight period of this species was over, the bands were renewed, and the inspections were continued until late April. Averages of only 2 and 4 other Geometrids per tree were taken. All were polyphagous pests of forest trees, especially oak, and as oaks were growing nearby, their presence on apple was considered to be accidental. The commonest of them was *Erannis* (*Hibernia*) *leucophaearia* (Schiff.) [*cf. R.A.E.*, A **36** 359]. It thus appeared that *O. brumata* was the principal Geometrid involved, and the possibility of infestation in spring by larvae transported by wind is briefly discussed.

Dosse (G.). **Die Wirkung von E 605 forte auf Läuse bei verschiedenen Temperaturen.** [The Effect of E 605 forte on Aphids at various Temperatures.]—*Anz. Schädlingsk.* **25** pt. 1 pp. 7–10, 9 refs. Berlin, 1952.

The rapidity of action of sprays of E 605 forte [an emulsion concentrate containing 50 per cent. parathion] on Aphids has been repeatedly observed in Germany to be affected by temperature. In detailed investigations in

June 1949, sprays were applied against *Aphis* (*Doralis*) *fabae* Scop. on broad beans in the field. E 605 forte at 0·015–0·045 per cent. caused 100 per cent. mortality in one day at 24–26°C. [75·2–78·8°F.] but only 95 per cent. after 2–3 days at 9–10°C. [48·2–50°F.]. Its slower action at low temperatures is attributed to reduced activity of the Aphids and slower penetration of the poison into the plants. In laboratory tests in 1950, potato tubers infested by *Rhopalosiphoninus latysiphon* (Davidson) and *Macrosiphum solanifolii* (Ashm.) were sprayed so that almost every Aphid came into contact with the poison and were then placed in a temperature gradient with a temperature range of 2–20°C. [35·6–68°F.]. E 605 forte at 0·005–0·01 per cent. caused complete or almost complete mortality in 24 hours throughout the range, and lower concentrations were as effective at low as at high temperatures. When untreated infested tubers were enclosed beside the treated ones, there was no mortality due to fumigant effect.

Godan (D.). **Untersuchungen zur Bekämpfung der Kohlschotenrüssler- und Kohlschotenmücken-Larven mit Ester- und Gamma-Hexa-Mitteln.** [Investigations on the Control of Larvae of *Ceuthorrhynchus assimilis* and *Dasyneura brassicae* with Parathion and γ BHC Products.]—*Anz. Schädlingsk.* **25** pt. 3 pp. 33–36, 6 refs. Berlin, 1952.

Ovipositing females of *Ceuthorrhynchus assimilis* (Payk.) are most numerous in rape fields in Germany when the plants are in flower. Both BHC and parathion give good control [*cf. R.A.E.*, A **38** 346], but their use on rape at this time is forbidden because of the risk to bees. Their effectiveness against larvae of the weevil and also larvae of *Dasyneura brassicae* (Winn.) in the pods was therefore investigated in the field and laboratory in 1951. The results of tests with sprays of E 605 forte [an emulsion concentrate containing 50 per cent. parathion], a commercial dust and a spray containing γ BHC, and E 605 Staub [methyl-parathion dust] are given in tables, and it is concluded that although all materials gave good results against young larvae, the quantities of dust required were uneconomically high. Complete mortality of larvae of both species was given by sprays of 1–1·5 per cent. E 605 forte (which was the most effective material) and such treatment immediately after the flowering period, when the bees have left the fields, is recommended. If many adults fly to the fields after treatment, a second application should be made after 8–10 days.

Haine (E.). **Studien zur Biologie des Zuckerrübenrüsslers** (*Tanymecus palliatus* **F.). I. Welche Pflanzen vermögen** *Tanymecus palliatus* **F. als Nahrung zu dienen?** [Studies on the Biology of *T. palliatus*. I. Which Plants are able to serve as Food for *T. palliatus*?]—*Anz. Schädlingsk.* **25** pt. 3 pp. 36–41, 17 refs. Berlin, 1952.

The distribution and food-plants of *Tanymecus palliatus* (F.) in Europe are reviewed from the literature. An outbreak of this weevil that occurred in a field planted with sugar beet near Bonn in 1948 led to feeding tests in 1949 in which adults were confined with leaves of 85 species and varieties comprising field-crop plants, soft, pip and stone fruits, forest trees and bushes, and weeds. Of this total, 12·9, 36·5 and 38·8 per cent. were very readily, readily and unwillingly attacked, while 11·8 per cent. were avoided. The plants in the first group included mangel, *Melissa officinalis*, sunflower, lettuce, peach and *Robinia pseudacacia*. Eggs were regularly deposited on plants of the first two groups, but oviposition on the others was rare. The weevils survived for nine days without feeding at all, and up to 14 days on plants on which they fed but little.

Bremer (H.). **Zur Rassenfrage bei** *Pegomyia hyoscyami* **Pz.** [Contribution to the Question of Races of *P. hyoscyami*.]—*Z. PflKrankh.* **57** pt. 11–12 pp. 415–416, 2 refs. Ludwigsburg, 1950.

From the results of earlier work, the author concluded that in Germany *Pegomyia hyoscyami* (Panz.) is a polyphagous species with several physiological races adapted to different food-plants but morphologically indistinguishable from one another. One of these races breeds on Chenopodiaceae and another on Solanaceae. Adults reared on beet were reluctant to oviposit on *Hyoscyamus* [*cf. R.A.E.*, A **26** 314] and few of the resulting larvae reached maturity, and in the field the larvae occurred on the two plants at different times.

There appears to be less differentiation in Turkey, however, where the fly is of little economic importance, and early in May 1950 the author observed larvae of *P. hyoscyami* simultaneously on *Hyoscyamus*, *Atriplex* and beet near Ankara. Field-collected infested leaves of beet and *Hyoscyamus* were placed with uninfested leaves of either of these plants. The larvae migrated in all cases to the fresh food when the original leaf withered, and they developed and pupated normally. Many of the pupae gave rise to a Braconid parasite believed to be *Opius spinaciae* Thoms., but of the adults of *Pegomyia* obtained, the majority, when offered a choice of leaves for oviposition, preferred those of the food-plant from which they had themselves originated.

Frey (W.). **Über das Auftreten der Minierfliege** *Phytomyza rufipes* **Mg. an Raps.** [On the Occurrence of *P. rufipes* on Rape.]—*Z. PflKrankh.* **58** pt. 1–2 pp. 10–20, 10 figs., 17 refs. Ludwigsburg, 1951.

Following the finding of *Phytomyza rufipes* Mg. in the leaf-stalks of young winter rape in Schleswig-Holstein in 1939 [*cf. R.A.E.*, A **31** 51], investigations were made on the bionomics of this Agromyzid, which is commonly known as a pest of cauliflower [*cf.* **25** 797, etc.]. Eggs were deposited on the underside of the leaves of rape, and the larvae mined in the veins and leaf-stalks, and rarely in the stems. In the laboratory, they also made small mines in the leaves, usually near a vein. Heavily infested leaves withered, but since the attack was mainly concentrated in the outer leaves that would normally fall in autumn, it did not cause serious injury. Pupation occurred in the soil, and the egg, larval and pupal stages averaged 3·7, 11·9 and 18·7 days, respectively, at a constant temperature of 21°C. [69·8°F.]. One female that lived for 15 days deposited 81 eggs, and the average number of eggs laid per day was five. Of 68 field-collected larvae 47 per cent. were parasitised by *Dacnusa* (*Rhizarcha*) *arcolaris* (Nees) and *Pleurotropis flaviscapus* Thoms.

The Drosophilid, *Scaptomyzella flava* (Fall.) was frequently found in the leaves of young winter rape. The larvae form communal mines, do not attack the stalk, and cause no appreciable damage. Of 143 field-collected larvae, 69·2 per cent. were parasitised by *Dacnusa temula* (Hal.) and *P. flaviscapus*.

Francke-Grosmann (H.). **Über eine bemerkenswerte Pappelblattwespe,** *Stauronema compressicornis* **(Fabr.) Benson.** [On a noteworthy Poplar Sawfly, *S. compressicornis*.]—*Z. PflKrankh.* **58** pt. 1–2 pp. 20–25, 5 figs., 2 refs. Ludwigsburg, 1951.

In view of the increasing importance of quick-growing poplars for afforestation in Germany, an account is given of observations on the bionomics of

Stauronema compressicornis (F.), a sawfly that injured various species and hybrids of *Populus* and also caused some damage to willow (*Salix viminalis*) in the gardens and glasshouse of a forestry research institute near Hamburg. The larvae were first observed in the glasshouse in mid-July. They fed on the leaves, leaving small holes, and surrounded themselves with a thread-like, frothy excretion the purpose of which was unknown. They became full-fed in 18–21 days, spun their cocoons in the soil or among fallen leaves, and overwintered. The pupal stage lasted 8–10 days, and the first adults emerged in late May or early June, so that there are probably at least two generations a year. The ratio of males to females was 8 : 1. Although this predominance of males suggested parthenogenesis, unfertilised females in the laboratory did not oviposit. Fertilised females laid about 20–30 eggs each singly in the veins on the lower surfaces of the fully developed leaves, and the egg stage lasted 8–10 days. Mortality was apparently low except in winter, but the larvae were not observed in numbers until the autumn. The damage to the plants was not serious, and control was required only because the infestation threatened other investigations. In a test, a parathion spray gave complete mortality of the larvae.

Blunck (H.). **Parasiten und Hyperparasiten von *Pieris rapae* L.** [Parasites and Hyperparasites of *P. rapae*.]—*Z. PflKrankh.* **58** pt. 1–2 pp. 25–54, 14 figs., 43 refs. Ludwigsburg, 1951.

Adults of *Pieris rapae* (L.) were more numerous in the area of the middle Rhine in 1950 than in any of the eight preceding years, with the possible exception of 1947 [*cf. R.A.E.*, A **40** 252]. The population reached its peak at the end of August, and savoy cabbage and brussels sprouts to the north-west of Cologne suffered considerable injury. Infestation was reduced though not eradicated by dusting with BHC, but the outbreak collapsed suddenly in October, well before the first frosts. No living larvae or pupae were found in November, and many had apparently been killed by the fungus, *Empusa* (*Entomophthora*) *sphaerosperma*. Damage was less severe near Bonn, on the other hand, although *E. sphaerosperma* was absent, and this was mainly due to insect parasites. Parasitism of the eggs by *Trichogramma evanescens* Westw. reached 77 per cent. in one batch examined, and most of the larvae were attacked by parasites, of which the Braconid, *Apanteles rubecula* Marsh., constituted well over 90 per cent., the Ichneumonid, *Anilastus ebeninus* (Grav.) was present in small numbers, and the Tachinid, *Zenillia* (*Phryxe*) *vulgaris* (Fall.), was rare.

Apanteles rubecula is a solitary parasite, and it was reared from host larvae taken in all instars from the second to the fifth. The parasite larvae and the process by which they leave their hosts when full-fed are described. Parasitised larvae behaved normally until they reached the fourth instar, after which they usually left their food-plants and prepared to pupate. The Braconid larvae emerged from them shortly afterwards and spun their cocoons. At room temperatures, the pupal stage lasted 10–11 days. Parasite larvae that formed cocoons in autumn overwintered in them, and there are probably at least 2–3 generations in a normal year.

Larvae of *A. rubecula* in their hosts were parasitised by *Tetrastichus rapo* (Wlk.) and *Mesochorus pectoralis* Ratz., notes on the habits of which are given, and a male and a female of *Gelis* (*Pezomachus*) sp. and a male of *Hemiteles areator* (Panz.) were obtained from cocoons of *A. rubecula* collected in the field. Both sexes of *Gelis* sp. are described. The larvae fed ectoparasitically on the *Apanteles* larvae in their cocoons, and development from egg to adult lasted 33–36 days at an average temperature of 15°C. [59°F.].

The absence of *A. glomeratus* (L.) as a parasite of *P. rapae* was remarkable. Its preferred host is *P. brassicae* (L.), but females reared from *P. brassicae* oviposited in the laboratory in larvae of *P. rapae* and adults were subsequently obtained, so that there was no apparent physiological reason for the absence of parasitism. The more isolated habits of the larvae of *P. rapae* may have been a contributory factor.

Nolte (H. W.). **Die Kapselvergilbung des Mohns. Eine Gallwespe als neuer deutscher Mohnschädling.** [Yellowing of Poppy Heads. A Cynipid as a new German Pest of Poppy.]—*Z. PflKrankh.* **58** pt. 3–4 pp. 89–92, 2 figs., 8 refs. Ludwigsburg, 1951. **Nochmals: Die Kapselvergilbung des Mohns.** [Again: Yellowing of Poppy Heads.]—*T.c.* pt. 7–8 p. 279.

In the summer of 1950, larvae of a Cynipid stated in the supplementary note to have been identified as *Timaspis papaveris* Kieff. were found mining in the stems of cultivated poppy (*Papaver somniferum*) in central Germany, causing premature ripening and yellowing of the seed heads, or preventing seed development altogether. They usually occurred at the base of the stalk, within about 2½ ins. of the soil, and the mines, which were just over an inch long, were formed in the walls. The numbers of larvae per plant averaged 4–5, but evidence of up to 40 was found. Cocoons were observed at the end of the mines in the second half of July. *T. papaveris* is known from other parts of Europe [*cf. R.A.E.*, A **33** 122] but has not previously been recorded from Germany, though it was collected there in 1934. The larvae were heavily parasitised.

Gäbler (H.). **Beobachtungen über den Kiefernprozessionsspinner** (*Cnethocampa pinivora* **Tr.**). [Observations on the Pine Processionary Caterpillar (*Thaumetopoca pinivora*).]—*Z. PflKrankh.* **58** pt. 3–4 pp. 92–96, 4 figs., 6 refs. Ludwigsburg, 1951.

An account is given of observations on the bionomics of *Thaumetopoca* (*Cnethocampa*) *pinivora* (Treit.) made during an outbreak on pine near Hoyerswerda, east-central Germany, in 1949–51 some of which were not in agreement with previous records. The eggs were laid on the needles in cylindrical batches. It is frequently assumed that the females lay all their eggs in one batch, but since two were often found on the same twig or even on adjacent pairs of needles on crowns containing only 10–12 batches in all, it is considered probable that some females deposit two. Records are given of the numbers of eggs per batch in the different years.

The sex ratio among field-collected pupae in the winter of 1949–50 was 1 : 1. About 80 per cent. of the pupae gave rise to adults in 1950, the rest remaining in diapause, and larvae were first observed towards the end of March. They passed through four instars each lasting 3–4 weeks in the laboratory. Injury was heavy in alternate seasons, the life-cycle lasting two years [*cf. R.A.E.*, A **25** 308]. Tachinids, including *Carcelia processionea* (Ratz.), parasitised 10 per cent. of the larvae and left their hosts when these had reached the prepupal stage. A further 10 per cent. of the prepupae and pupae were killed by the fungus, *Isaria farinosa*.

Owing to the uneven distribution of the pupae in the soil and the occurrence of the pupal diapause, pupal counts are not reliable as a basis for forecasting future outbreaks, and egg counts are therefore recommended. Embryonic development is completed by October, and investigation then

vill show the size of the population likely to overwinter. Mortality by this ime rarely exceeded 9 per cent. in 1950.

Adhesive bands round the trunks have been recommended for control and gave promising results in a test in 1949. It is pointed out, however, that as he eggs are deposited in the crowns, and the larvae migrate little before the hird instar, while some may fall from the trees or not migrate at all, the bands are unlikely to be effective against a heavy outbreak.

WIESMANN (R.). **Über einen biologischen Test zum Nachweis und zur Bestimmung von synthetischen Kontaktinsektiziden bei Bienenvergiftungen.** [On a biological Test for detecting and determining synthetic Contact Insecticides in poisoned Bees.]—*Z. PflKrankh.* **58** pt. 5–6 pp. 161–171, 3 figs., 4 refs. Ludwigsburg, 1951.

The author describes a method of bioassay for investigating cases of poisoning in honey bees due to DDT, BHC or parathion. Acetone extracts of the dead bees are prepared, the acetone evaporated, and house-flies (*Musca domestica* L.) exposed to the residues in petri dishes. The insecticide concerned can be identified from the symptoms shown by the flies, which are described for each material, and the quantities present by comparing the times required for knockdown with those for known amounts. Extracts from 100 bees are sufficient for good results. Mosquitos (*Culex pipiens* L. or *Aëdes aegypti* (L.)) can also be used for bioassay of DDT. The BHC in mixtures of BHC and DDT can be determined by exposing flies to the fumigant action of the residue or by additional tests with insects such as *Carausius morosus* Brunn. that are susceptible to BHC but not to DDT. The results of several tests are shown as examples.

HÄFLIGER (E.). **Beitrag zur Frage der Maikäferbekämpfung. Mit Resultaten der Engerlingsgrabungen im Anschluss an die Maikäferaktion Wallis 1950.** [Contribution to the Question of Cockchafer Control, with the Results of Soil Excavation for Larvae in Connection with the Valais Cockchafer Campaign of 1950.]—*Z. PflKrankh.* **58** pt. 5–6 pp. 171–178, 5 figs., 6 refs. Ludwigsburg, 1951.

The relative advantages and disadvantages of controlling the larvae of *Melolontha melolontha* L. in Switzerland by means of soil insecticides [*cf. R.A.E.*, A **41** 328] and of preventing infestation by spraying woodland against the newly emerged adults [*cf.* **41** 248] are compared and discussed. The desirability of adopting the second method depends on the relative sizes of the area requiring treatment and the one to be protected. In both cases, fruit trees have to be sprayed to prevent damage by the adults in spring, and in the Swiss canton of Valais, where fruit is intensively cultivated, this necessity justified woodland treatment in 1950 that would otherwise have been uneconomical. Some 16,800 acres of cultivated land was involved, and DDT was applied in sprays from aeroplanes and ground equipment, and also to some extent in dusts and smokes, to orchards, forest edges and shrubs in May. Counts of first- and second-instar larvae in meadowland in various treated areas and (in brackets) in control areas where the beetles had been compulsorily collected by hand and had in some cases been less numerous than in the treated areas showed that the numbers per sq. metre ranged from 2·3 (9·36) to 10·96 (41·74). These reductions were great enough to prevent serious damage.

Jancke (O.). **Beiträge zur innertherapeutischen Schädlingsbekämpfung III.** [Contributions to the Control of Pests by the internal Treatment of Plants. III.]—*Z. PflKrankh.* **58** pt. 5–6 pp. 179–185, 4 figs., 5 refs. Ludwigsburg, 1951.

In this paper, which is one of a series [*cf. R.A.E.*, A **19** 725; **21** 379], the results are summarised of numerous tests in Germany in which schradan (as Pestox III) and preparation 8169 [Systox (O,O-diethyl O-2-(ethylmercapto)ethyl thiophosphate)] were tested against Aphids and Coccids in the laboratory, glasshouse or field. The concentrations at which the two materials were used were of the order of 0·1–1 and 0·05–0·2 per cent., respectively. Schradan killed *Myzus cerasi* (F.) on cut cherry twigs when applied in nutrient solution and *Aphis* (*Doralis*) *fabae* Scop. on broad beans in the field when watered round the roots. It was inferior to Systox against *Quadraspidiotus perniciosus* (Comst.) on young apple trees in pots, and Systox also proved effective against *A. fabae* on *Phascolus* beans, *A.* (*D.*) *pomi* Deg. and *Eriosoma lanigerum* (Hsm.) on apple, and *Phylloxera vitifoliae* (Fitch) on the leaves of grape vine, and temporarily protected the plants from reinfestation.

When applied in sprays, Systox killed *P. vitifoliae* on vine leaves and *E. lanuginosum* (Htg.) and *Byrsocrypta* (*Tetraneura*) *ulmi* (L.) in their galls on elm. In the experiments on elm, the material was translocated upwards through the tree but not horizontally from twigs on one side of a branch to those on the other. When *Phaseolus* and broad beans were soaked in solutions of Systox before sowing, the resulting plants resisted infestation by *A. fabae* for periods of several weeks.

The root form of *P. vitifoliae* was not affected by Systox sprays applied to the vines, and spraying individual lower twigs of young apple and plum trees gave no control of Aphids or *Q. perniciosus* on higher untreated parts.

Unterstenhöfer (G.). **Neue Entwicklungsmöglichkeit in der Blattlausbekämpfung mit chemischen Mitteln.** [New Possibility of Development in the chemical Control of Aphids.]—*Z. PflKrankh.* **58** pt. 7–8 pp. 268–275, 2 graphs. Ludwigsburg, 1951.

The bionomics of Aphids, the ways in which they injure plants directly by feeding and indirectly as vectors of virus diseases, and the difficulties of controlling them are briefly outlined. The advantages of systemic insecticides are explained, and the general results are given of experiments in Germany in which preparation 8169 (Systox [O,O-diethyl O-2-(ethylmercapto)ethyl thiophosphate]) proved effective against various Aphids and Tetranychid mites. The way in which Systox kills insects feeding on treated plants is not known with certainty, but a fumigant effect has been demonstrated and it is assumed that the insecticide is absorbed through roots or leaves, rapidly distributed throughout the plant and given off as toxic vapour.

Linskens (H. F.). **Über die Änderung der Benetzbarkeit von Blattoberflächen nach Spritzungen.** [On the Change in Wettability of Leaf Surfaces after Spraying.]—*Z. PflKrankh.* **58** pt. 9–10 pp. 327–332, 2 graphs, 17 refs. Ludwigsburg, 1951.

It has been reported in the literature that spraying with parathion causes increased yield or improves the condition of plants apart from its insecticidal effect. The author points out that the constituents of the prepared sprays have no nutritive value, and shows from contact-angle measurements that

the wettability of leaf surfaces was increased after spraying with 0·1 per cent. E 605 f [an emulsion concentrate containing 70 per cent. parathion]. The stimulating effect has been reported only in exceptionally dry years, and it is concluded that sprayed plants are able to absorb more dew as a result of the increased wettability. Spraying with a proprietary emulsifier and a wetting agent alone had a similar effect.

Müller-Kögler (E.). **Über eine Erkrankung der Kiefernspanner-Altraupen und -Vorpuppen.** [On a Disease of the full-grown Larvae and Prepupae of *Bupalus piniarius*.]—*Z. PflKrankh.* **58** pt. 11–12 pp. 404–410, 9 refs. Ludwigsburg, 1951.

The following is based on the author's summary. Bacilli of the group of *Bacillus fusiformis* were isolated from diseased larvae and prepupae of *Bupalus piniarius* (L.) taken in pine stands in Mecklenburg in 1938. Pupae became infected in the laboratory following pricking with a needle that had been contaminated with material from diseased prepupae, and typical symptoms developed.

Schaerffenberg (B.). **Abflammversuch gegen die St.-José-Schildlaus.** [Experiment in burning off San José Scale.]—*Z. PflKrankh.* **58** pt. 11–12 pp. 410–412, 3 refs. Ludwigsburg, 1951.

Apple trees 10–15 years old in an orchard near Graz, Austria, were so heavily infested by *Quadraspidiotus perniciosus* (Comst.) that it was considered impossible to save them by normal control methods. After preliminary experiments in November–December 1947, a flame-thrower burning a mixture of propane and tar oil was used with excellent effect in January and early February 1948. The apparatus was capable of throwing a flame over 16 ft. long, but a flame 3 ft. long and 8 ins. wide, with a temperature of about 1,400°C., was sufficient. The buds on treated twigs taken into a heated glasshouse opened 8–14 days earlier than untreated ones, but the trees came into leaf at the normal time in April. A few branches had died, as a result of infestation rather than of the treatment, but in general many dormant buds had been stimulated, and growth, foliage and blossom were heavier than normal and more fruit was set. Not more than 0·5 per cent. of the scales survived the treatment, and the survivors were found mainly at the bases of the trees where they had been protected by grass. The age of the trees and the time of the treatment were apparently important, since the bark of young trees and nursery stock 3–4 years old treated in February or March suffered severe damage. Flame treatment should not be applied year after year, because of its stimulating effect on tree growth.

Stelzner (G.). **Schädigung von Kartoffelpflanzen und anderen Solanaceen durch die Milbe *Avrosia translucens* Nietner.** [Injury to Potato and other Solanaceous Plants by the Mite *A. translucens*.]—*Z. PflKrankh.* **58** pt. 11–12 pp. 412–416, 6 figs., 8 refs. Ludwigsburg, 1951.

Glazing, browning, deformation and shedding of the leaves of potato and other solanaceous plants in a glasshouse in Germany in 1939 were found to be due to infestation by the Oribatid, *Avrosia translucens* (Nietn.). This mite attacks many plants in the Far East and was recorded from glasshouses in Germany for the first time in 1941–42 [*cf.* also *R.A.E.*, A **29** 536]. Sprays containing sulphur gave good control.

Bodenheimer (F. S.) & Shulov (A.). **Egg-development and Diapause in the Moroccan Locust** (*Dociostaurus maroccanus* **Thnb.**).—*Bull. Res. Coun. Israel* **1** no. 1–2 pp. 59–75, 7 figs., 8 refs. Jerusalem, 1951.

From laboratory studies in 1942–47 on the development of eggs of *Dociostaurus maroccanus* (Thnb.) from Iraq, the authors describe 20 more or less arbitrary stages, in which four main phases of development were distinguished. These comprise an initial period before the formation of the embryo, which may be followed by a quiescent period; anatrepsis, which may continue for several months; a quiescent period preparatory to katatrepsis; and katatrepsis and the completion of growth, which do not occur until the onset of favourable conditions. These phases are discussed in relation to the normal climatic cycle in northern Iraq, to which they are well adapted. The eggs are deposited towards the end of May. The third phase begins rather more than five months after oviposition, and lasts until conditions favourable for the fourth, comprising suitable temperatures and the presence of contact water, occur in late February or March of the following year. Hatching occurs in March–April [*cf. R.A.E.*, A **33** 199]. If no contact water is available within 12–14 months of oviposition, however, the eggs dry up. Laboratory experiments indicated that post-diapause temperatures of 15–27°C. [59–80·6°F.] were the most suitable for hatching; the threshold of development was estimated at 12·1°C. [53·78°F.], and the upper limit appeared to be about 32°C. [89·6°F.]. In experiments in which the eggs were exposed to various conditions of temperature, relative humidity and contact moisture, it was in general not possible to eliminate the resting stages, though some evidence was obtained that partial hatching may take place if optimum conditions occur in autumn; such conditions are not usual in the normal habitats of *D. maroccanus*.

Distribution Maps of Insect Pests.—Series A, nos. 31–36. London, Commonw. Inst. Ent., 1953.

These maps are nos. 31–36 of a series already noticed [*R.A.E.*, A **40** 203; **41** 161] and deal, respectively, with *Paratetranychus pilosus* (C. & F.), *Plutella maculipennis* (Curt.), *Alabama argillacea* (Hb.), *Gilpinia polytoma* (Htg.), *G. hercyniae* (Htg.) and *Clemora smithi* (Arr.).

Peterson (A.). **A Manual of entomological Techniques.**—7th edn., 11¼ × 8½ ins., v + 367 pp., 182 pls., refs., multigraph. Ann Arbor, Mich., Edwards Bros. Inc., 1953. Price $7.50.

The text of this edition of a manual on equipment and methods for entomological investigations [*cf. R.A.E.*, A **36** 9] has been greatly extended and almost entirely rewritten. It includes information on field insectaries, the measurement of ecological factors, cage microclimates, materials for cages, general and specific rearing methods for insects and mites, and methods for marking, collecting, killing, preserving and making microscopic preparations and drawings of insects. Plates of outline drawings illustrating the various techniques make up the greater part of the volume, and 22 new ones are included.

Ahrens (L.) & Vandenput (R.). **La lutte contre les ennemis des principales cultures pérennes de la Cuvette Centrale Congolaise.**—204 pp., 20 col. pls., 77 figs. Brussels, Minist. Colon. Belg., Dir. Agric., 1952.

The main part of this book on the control, mostly by chemical means, of the insect and other animal pests, fungi and diseases that attack perennial

crops in the central Congo basin of the Belgian Congo consists of four chapters containing instructions for controlling specific pests of coffee, oil palm (*Elaeis* [*guineënsis*]), cacao and rubber, with indications of the type of damage caused and the appearance of the pest. An appendix to the chapter on coffee contains descriptions of all stages of *Dichocrocis crocodora* (Meyr.) and detailed information on its bionomics, the damage it causes and the control of the different stages [*cf. R.A.E.*, A **41** 15, etc.]. General information on the choice of materials and formulations, the care of equipment and the organisation of control operations is given in two short introductory chapters, and a third deals with the formulations, preparation and uses of some of the principal insecticides and fungicides and with the precautions to be adopted in using them.

Cuillé (J.). **Recherches sur le charançon du bananier** *Cosmopolites sordidus*, **Germ. Monographie de l'insecte et recherches de ses chimiotropismes.**—*Sér. tech. Inst. Fruits Agrumes colon.* no. 4, [4+] 225 pp., 8 pls., 63 figs., 201 refs. Paris, 1950.

The greater part of this monograph consists of an account of investigations on *Cosmopolites sordidus* (Germ.) on banana in French Guinea. It is in three parts, of which the first is mainly introductory and contains reviews of attempts at biological control of the weevil in different countries, its world distribution and bionomics, and investigations on the influence of physical factors on its activity and development. The second contains an account of laboratory and insectary observations on the behaviour of *C. sordidus* carried out in an attempt to improve the effectiveness of baiting, which is the measure commonly applied against it. The aspects considered are the attractiveness to the adults for shelter and oviposition of the different parts of the banana plant, the variation in attractiveness with seasonal conditions, the stimuli responsible, and the ways in which chemical attraction is influenced by other stimuli and by physiological factors. In the third part, the economic importance of *C. sordidus*, the sources and development of infestation and the factors influencing damage are discussed, and the various preventive and control measures are reviewed. In laboratory experiments with some recently developed insecticides, dusts of BHC, a polychlorocyclohexane sulphide [*cf. R.A.E.*, A **35** 313] and DNC proved highly toxic to weevils confined on them and considerably more effective than DDT, but BHC appeared to act as a repellent when applied to baits of the usual type.

Lamb (K. P.). **Tomato Gall Mites from Morocco.**—*Bull. ent. Res.* **44** pt. 3 pp. 401–404, 2 figs., 4 refs. London, 1953.

Tomato gall mites received from Morocco were found to comprise two species, *Vasates lycopersici* (Massee), which is here recorded from North Africa for the first time, and *Aceria lycopersici* (Wolff.). The specimens of *A. lycopersici* could not be separated from *A. cladophthirus* (Nal.) on the character employed in the author's recent revision [*R.A.E.*, A **41** 317], and he concludes that *A. cladophthirus* is a synonym of *A. lycopersici*. The paper includes descriptions of the females of *A. lycopersici* and *V. lycopersici* based on the Moroccan specimens; those of *V. lycopersici* were morphologically identical with specimens from New Zealand. Both species probably occur in most countries where tomatos are cultivated, though *A. lycopersici* has not been recorded from New Zealand or Australia.

Vesey-FitzGerald (D.). **Review of the Biological Control of Coccids on Coconut Palms in the Seychelles.**—*Bull. ent. Res.* **44** pt. 3 pp. 405–413, 2 refs. London, 1953.

A survey was made in 1952 of the status of the Coccid pests of coconut in the Seychelles and the Coccinellid predators introduced in 1936–38 for their control [*cf. R.A.E.*, A **30** 214, etc.]. Outbreaks on coconut occurred in several areas during 1945 and 1946, and were brought under control by *Chilocorus nigritus* (F.), which had become the commonest of the introduced species [*cf.* **30** 214], and only local outbreaks that were quickly reduced by the predators had been reported subsequently. *C. nigritus*, all stages of which are described, was well established on the six islands visited. The larvae fed on various Diaspines and there was some evidence that they also attack Lecaniines. Eggs are laid singly or in small groups in sheltered places, often under dead Diaspines. One female laid 13 eggs in five days, but the usual number is probably greater. The life-cycle lasted about 30 days in the insectary, the egg and pupal stages occupying 5 and 8 days, respectively. *C. distigma* (Klug) was relatively scarce, though widespread; it was not observed on coconut but was found attacking *Pseudaulacaspis pentagona* (Targ.) on papaya on three islands. *Exochomus ventralis* Gerst. and *E. flavipes* (Thnb.) were present in some numbers on Mahé, where they fed on *Coccus mangiferae* (Green) on jak fruit [*Artocarpus integer*] and another Coccid on *Casuarina*. They are assumed to have controlled Lecaniines on many fruit and timber trees that were formerly heavily infested: *Eucalymnatus tessellatus* (Sign.) was much reduced on coconut, but neither Coccinellid was found in association with it. *Rodolia cardinalis* (Muls.), which was introduced against *Icerya seychellarum* (Westw.) on various plants in 1938 but was thought not to have become established [*cf.* **29** 82], was found in great numbers on one island and was widely distributed on two others, to one of which it had apparently spread naturally. It was always associated with *I. seychellarum*, usually on *Casuarina*, the needle-like foliage of which may protect it from attack by ants of the genus *Technomyrmex* [**29** 82], but also on *Citrus*, avocado and jak fruit. The observed decrease in *I. seychellarum* in recent years is probably due to this Coccinellid and to *R. chermesina* Muls., though it is still a minor pest in orchards and forest nurseries.

The status of the various Coccids associated with coconut in the Seychelles is briefly discussed. Of the four species that were formerly of major importance, *Ischnaspis longirostris* (Sign.) was only once found on coconut; it was still present, though not injurious, on coffee, and was not attacked by *Chilocorus nigritus* on this food-plant. *Chrysomphalus ficus* Ashm. occurred in localised patches of medium density on three islands, but no outbreaks were found. A few localised outbreaks of *Pinnaspis buxi* (Bch.) were observed on Mahé, with yellowing and rolling of the foliage, but most of the Coccids on the older leaves were dead, and they were everywhere attacked by *Chilocorus nigritus*. *E. tessellatus* was frequent on the lower surface of the older leaves, chiefly on palms growing at sea level, but the general incidence was much lower than in 1939, and the sooty mould formerly associated with it was rare on coconut. Sooty mould was still present on other trees, and the Coccids chiefly responsible for its development were *E. tessellatus*, *Coccus mangiferae* and *Pulvinaria* (*Protopulvinaria*) *pyriformis* Ckll. on cinnamon, on which *Technomyrmex* is abundant and the predators do not occur, *C. mangiferae* on mango, *Eugenia* and jak fruit, *C. elongatus* (Sign.) on guava, and *Icerya seychellarum* on a wide range of food-plants, notably *Citrus* and *Casuarina*.

The economic effects of the control of the Coccids on coconut is discussed. The production of copra has shown a marked increase, which is attributed

to their reduction, and since the predators have reached a state of equilibrium with their prey, it is probable that they will be able to prevent any other Coccid pest of coconut that may be accidentally introduced from becoming injurious.

Bletchly (J. D.). **The Effect of Hydrogen Cyanide on the Eggs of the Common Furniture Beetle,** *Anobium punctatum* **(Deg.).**—*Bull. ent. Res.* **44** pt. 3 pp. 415–418, 4 refs. London, 1953.

In the tests described, which were carried out at 25°C. [77°F.] and 70 per cent. relative humidity, eggs of *Anobium punctatum* (Deg.) that had been laid on small blocks of pine sapwood covered with muslin [*R.A.E.*, A **41** 231], and had completed 8–67 per cent. of their development, and larvae of three larger size groups in cages were exposed to hydrocyanic acid gas at a concentration of 4·25 mg. per litre in a steel fumigation chamber for periods of 1–10 hours. Complete mortality of the eggs was obtained at all exposures and stages of development. The results for the larvae in general confirmed those of earlier investigators [**25** 492], but complete mortality was given only by the longest exposure period. Only about 5–10 per cent. of the larvae survived the shorter exposures, however, and the survivors all belonged to the two largest size groups. Since the eggs are less resistant than the larvae, it is concluded that commercial treatments with HCN that are adequate against the latter will also destroy the eggs.

Ankersmit (G. W.). **DDT-Resistance in** *Plutella maculipennis* **(Curt.) (Lep.) in Java.**—*Bull. ent. Res.* **44** pt. 3 pp. 421–425, 1 pl., 2 refs. London, 1953.

With the exception of *Crocidolomia binotalis* Zell., *Plutella maculipennis* (Curt.) is the most important insect pest of cabbage in Indonesia. In Java, good control of *P. maculipennis* was formerly given by spraying 5–6 times with DDT, the total amount applied being about 4·5–5·5 lb. DDT per acre, but in 1951, this measure failed in Lembang (western Java), and about 40 lb. DDT per acre in nearly twice the number of applications was ineffective, even when reinforced with 1 per cent. lead arsenate and small amounts of DDT in kerosene. In November–December 1951, dusts and sprays of BHC gave good control, but this material is liable to affect the flavour of the cabbages and of potatoes grown in rotation with them.

Investigations to determine whether a resistant population had developed were begun in May 1951. Strains originating from larvae collected in Lembang and in Patjet, where DDT still gave good control, were reared in the laboratory, and larvae of various generations were dusted with 5 per cent. DDT in an apparatus already noticed [*R.A.E.*, A **26** 254]. The mortality percentages in the second, third, fifth and eighth generations were 20, 28, 23 and 64, respectively, for the strain from Lembang and 100, 100, 84 and 96 for that from Patjet. In a further test, larvae of different generations originating from pupae collected at Lembang in September 1951 were exposed to various dusts and the results again compared with those for a similar strain from Patjet. The mortality percentages for the Lembang and (in brackets) the Patjet strain were 24 (96) and 16 (92) in the first and fourth generations, respectively, for 5 per cent. DDT, 82 (100) in the third for 5 per cent. BHC, 72 (88) and 72 (92) in the third and fifth for 5 per cent. toxaphene, and 96 (92) and 92 (100) in the first and second for a derris dust containing 8·3 per cent. rotenone.

In field tests, the DDT dust applied six times at intervals of about a fortnight, beginning in early October, to experimental plots at Patjet, gave good control and was slightly more effective than dusts of 5 per cent. BHC or toxaphene. At Lembang, however, where eight weekly applications were made between December 1951 and February 1952, a dust of 5 per cent. DDT and one of pyrethrum (1 per cent. pyrethrins) in talc (1 : 2) and sprays of 0·105 per cent. wettable DDT and an emulsified solution of 0·08 per cent. DDT gave no control. An emulsified solution of 0·0105 per cent. γ BHC reduced infestation by about half, and one of 0·078 per cent. toxaphene and a dust of derris (8·3 per cent. rotenone) diluted 1 : 5 reduced it by about 90 per cent. On the basis of these results, toxaphene is recommended for use during most of the growing period, with the substitution of derris in the last application; this is desirable to avoid toxic residues and to delay so far as possible the development of resistance to toxaphene, which appeared already to be in progress. The author points out that since *P. maculipennis* has 15–18 generations a year and DDT was first used in large quantities against it at the end of 1948, about 30–40 generations were required for the development of resistance.

Williams (G.). **Field Observations on the Cacao Mirids, *Sahlbergella singularis* Hagl. and *Distantiella theobroma* (Dist.), in the Gold Coast. Part II. Geographical and Habitat Distribution.**—*Bull. ent. Res.* **44** pt. 3 pp. 427–437, 1 map, 7 refs. London, 1953.

In this second part of a series [*R.A.E.*, A **41** 238], the author discusses the distribution of *Sahlbergella singularis* Hagl. and *Distantiella theobroma* (Dist.), which attack cacao in West Africa. The ranges of these Mirids overlap in the Gold Coast, but *D. theobroma* was not found in the Northern Territories during a survey of possible food-plants in April 1947, and the northern limits of both may lie in a belt immediately to the north of the main cacao-growing area where there are small, isolated stands of cacao, some of which are infested, whereas others are not.

It has been considered that *S. singularis* prefers mature trees and *D. theobroma* seedlings [*cf.* **32** 287], but in field observations in the Gold Coast between November 1947 and July 1948, 31 per cent. of the examples of *S. singularis* collected on cacao were taken from seedlings and 58 per cent. of *D. theobroma* from mature trees [*cf.* **39** 373]. The mean ages of cacao trees attacked by the two species were estimated to be 15·4 and 11·8 years, respectively [*cf.* **37** 88], but either species may occur on cacao of any age, and the species present can best be recognised by the type of damage; when feeding on stems, *D. theobroma* is virtually restricted to chupons, whereas *S. singularis* feeds also on the fan branches. In five Mirid pockets, the proportion of chupons to fans and of *D. theobroma* to *S. singularis* both increased with degree of deterioration. Young cacao produces more chupons than mature trees, and the apparent association of *D. theobroma* with young trees is a result of its restriction to chupons in feeding.

All the trees in a plot in which observations were made were visited by Mirids, but at any one time attack was concentrated on only a small number of trees and breeding was restricted to a limited number of chupons even on these. Owing to the destructive nature of Mirid feeding and the sedentary habits of the nymphs, these chupons were rapidly destroyed, and the proportion of nymphs to reach maturity was accordingly reduced. In the laboratory, the mean number of eggs laid per female was 32·3 for *D. theobroma* and 51·2 for *S. singularis*, but whereas the former laid 5·5

eggs per day for days when oviposition took place, *S. singularis* laid only 4·2, and this difference in oviposition rate was supported by field observations. It is concluded that the ability of the two closely related species to exist together in the same habitat is a result of those slight differences in habits. *S. singularis* produces more eggs, but is more diffusely distributed. *D. theobroma* is virtually restricted to chupons, but can quickly build up a large population in favourable areas by reason of its greater rate of egg production.

In Nigeria, *D. theobroma* is not an important pest of cacao, and this is attributed partly to cultivation without overhead shade, a method that does not favour the production of chupons, and to an observed reduction in the oviposition rate of *D. theobroma* and increase in that of *S. singularis*.

Parkin (E. A.). **The Susceptibility to DDT Dust of Coleoptera infesting Stored Products.**—*Bull. ent. Res.* **44** pt. 3 pp. 439–444, 1 graph, 8 refs. London, 1953.

Populations of insects infesting stored products generally consist of several species, and though it is necessary in control work to concentrate on the one or two of primary importance, information on the susceptibility to insecticides of a wide range of insects is desirable so that any possibility of the primary species being replaced by a secondary one of greater resistance can be avoided. The resistance to a dust of 5 per cent. DDT in talc of Coleoptera of 36 species that infest stored products was accordingly investigated, adults and larvae being exposed in petri dishes containing a deposit of the dust and the periods required for 50 and 95 per cent. mortality determined. The results are given in a table, and in two lists, one for the larvae and one for the adults, in which the species are grouped according to the periods required for 95 per cent. mortality. Among the adults, Ptinids were relatively resistant, Dermestids susceptible, Bruchids very susceptible, and Tenebrionids very variable. In general, larvae were more resistant than the corresponding adults, especially in the case of *Lasioderma serricorne* (F.) and *Trogoderma granarium* Everts. The slopes of the probit regression lines were not significantly correlated with the log-times for 50 per cent. mortality of the adults. No definite connection could be seen between degree of resistance and size, or the presence of scales or setae; the more active insects tended to be the more susceptible. A short review of the literature on the resistance of stored-product pests to DDT dusts is included.

Howe (R. W.) & Burges (H. D.). **Studies on Beetles of the Family Ptinidae. IX. A Laboratory Study of the Biology of *Ptinus tectus* Boield.**—*Bull. ent. Res.* **44** pt. 3 pp. 461–516, 2 pls., 20 figs., 3 pp. refs. London, 1953.

The following is largely the authors' summary of this part of a series [*cf. R.A.E.*, A **41** 311, etc.]. *Ptinus tectus* Boield. occurs on a wide range of foodstuffs in all types of storage places, in warehouse refuse and in birds' nests. It is widely distributed in cool and temperate areas, but is rare in hot climates. In Britain, it survived the winter when exposed in a Stevenson screen to outdoor shade conditions and while seldom found in imported cargoes, many warehouses contain a population in the fabric of the premises. The larvae can bore through cellophane, card and textiles and

make impressions on wood. The fully fed larva spins a cocoon on the fabric of containers and buildings. The chief losses result from damage to packages due to perforation by the larvae and from contamination of high-grade produce by silk, but populations occasionally become so large as to reduce the food value of produce. The adults cannot penetrate sound linen bags, but oviposit through the meshes.

In a series of consecutive experiments, carried out so far as possible under identical conditions, variations in the duration of development and in the weight of the adults at emergence were greater than would be expected by chance and could not be related to any inconsistency of technique or environment. It is therefore desirable to conduct comparative experiments simultaneously.

Development was most rapid between 23 and 27°C. [73·4 and 80·6°F.] [*cf.* **30** 161]. The highest temperature at which it was completed was 28°C. [82·4°F.] and the lowest between 5 and 10°C. [41 and 50°F.]. Adults were most and eggs and young larvae least resistant to high temperatures. Adults died in four hours at 41°C. [105·8°F.], and large larvae at 38°C. [100·4°F.]. Adults not provided with water died in eight days and pupae and large larvae in 12 and 9 days, respectively, at 35°C. [95°F.], and the corresponding periods at 33°C. [91·4°F.] were 16, 16 and 22 days. At 30°C. [86°F.], when drinking water was provided, the adults were the most resistant and survived for up to 124 days. Adults were also more resistant than larvae to very low temperatures. At about −3°C. [26·6°F.], adults and large larvae were killed by exposure for 56 and 13 days, respectively, but they survived exposure for 36 and 6 days. The transference of larvae from near-optimal temperatures to temperatures at which development is slow and the reverse transfer exerted only a transitory effect on the rate of development, which rapidly became stabilised at the normal speed for the new temperature. Beetles bred at low temperatures were heavier than those bred at high temperatures within the range in which mortality is low.

High humidity favoured development except when mould growth was extensive. Development was quickest at 70–90 per cent. relative humidity and relative humidity of about 40 per cent. was the lowest at which it was completed [**31** 231]. At humidities below 50 per cent., development was slow and hatching greatly retarded, probably owing to hardening of the egg-shell. Low humidities, however, sometimes slightly decreased the pre-emergence period. Under favourable conditions, 80 per cent. or more of the eggs hatched and post-embryonic mortality was slight.

Development was rapid on wheatfeed, flours and other foods with a high carbohydrate content and also on fishmeal and some other foods with a high protein content [*cf.* **31** 231]. It was not completed on greasy foods, and mortality was heavy on some foods that become sticky in moist conditions owing to a high sugar content. Very hard foods, such as dried strips of potato, were resistant to penetration by young larvae. Growth was usually more rapid if the foods were finely ground than if presented to the young larvae as lumps [*cf.* **38** 478]. The addition of 5 per cent. by weight of yeast improved most foods. Development occurred in some warehouse dusts and in rat droppings. Larvae developed more quickly on a mixture of fish-meal and wheatfeed than on either food alone. Experiments with synthetic foods showed that deficiency of sterol and absence of carbohydrate retarded development. The proportion of glucose to casein had much less effect.

When there was more than one larva per tube, some cannibalism resulted. The duration of development increased progressively and the weight of the adults decreased as the number of insects per tube increased, even though enough food was present for normal development [*cf.* **34** 62].

The sex ratio was approximately 1 : 1. The mean weight of females was greater than that of males. A regular supply of drinking water was necessary for maximum length of life and egg output [*cf.* **31** 231], and when it was provided, both sexes survived for about the same period. Adults lived longest at 13°C. [55·4°F.], at which females survived for a mean of 387 days; adult life was shortened by increasing temperature until at 30°C. the females survived for a mean of only 69 days. Only when no drinking water was provided did low humidity shorten adult life. Oviposition began two days after emergence at 23°C. and continues throughout life. More eggs were produced by adults isolated in pairs than by those kept in groups. The total egg output was greatest at 23–25°C. [77°F.] with a mean of 516 eggs, and the largest number from a single female was 962. At 25°C. and above, the rate of oviposition was highest during the first few weeks of life, after which it steadily decreased, the rate of decrease being most rapid at the highest temperature. The greatest sustained oviposition rate, exceeding 15 eggs per female per week for six weeks, was at 27°C., which is near the maximum for development. At 27°C., oviposition ceased in about 30 weeks, whereas at 20°C., the rate of egg laying declined less rapidly and averaged 5 eggs per female per week for more than 45 weeks. The highest temperature for oviposition is probably a little above 30°C. Oviposition is slow at 13°C. but still occurs below 5°C.

Eggs are normally laid in food products and few are deposited in such materials as wool. Under unfavourable conditions, such as absence of food, mature eggs are resorbed, but a few are stored in the abdomen and are probably laid when favourable conditions return. Females confined on different materials for a week laid more eggs in fishmeal and copra than in wheatfeed or flour. Most eggs were not therefore laid in the food in which development was most rapid. When offered a choice of materials in which to oviposit, *P. tectus* showed no marked preference either for those favouring the highest egg output or for those on which development was quickest [*cf.* **40** 5].

Inherited variations were noted in the length of the hind wings and in an emargination of the tip of each elytron. Beetles with long wings were heavier than those with short ones.

The problem of correlating the results of laboratory experiments under constant conditions with conditions in the field is discussed; a map is given showing the areas throughout the world where *P. tectus* would be expected to maintain itself, and its theoretical and recorded distributions are compared.

Salkeld (E. H.) & Potter (C.). **The Effect of the Age and Stage of Development of Insect Eggs on their Resistance to Insecticides.**—*Bull. ent. Res.* **44** pt. 3 pp. 527–580, 27 figs., 3 pp. refs. London, 1953.

The following is based on the authors' summary. Laboratory spraying experiments were carried out with DDT, allethrin, DNC (triethanolamine) and HETP (hexaethyl tetraphosphate) on eggs of different ages of *Diataraxia oleracea* (L.) and with the last three on those of *Ephestia kuehniella* Zell. and *Dysdercus fasciatus* Sign. under controlled conditions of temperature and humidity. Relative resistance was defined as the median lethal concentration of each insecticide for each age group, expressed as a proportion of that for the oldest, and resistance-age curves were obtained by plotting this against age. The shape of the curves varied with incubation temperature, species and insecticide. Eggs of *Diataraxia oleracea* showed very little variation with age in resistance to any of the insecticides

when incubated at 75°F. and 60–70 per cent. relative humidity, apart from barely significant indications that day-old eggs were the most resistant to DDT and HETP, but definite resistance/age effects were obtained with allethrin and DNC (triethanolamine) when the eggs were incubated at 57°F., the youngest (1-day) and the oldest (14-day) eggs tested being the least resistant.

The resistance/age curves for the two species of Lepidoptera tested under similar conditions, though varying slightly in shape, had a general similarity, but those for the *Dysdercus* eggs were very different. This is ascribed to probable differences in chorion structure and process of development between the two orders. With any one species, the shape of the curve differed from one insecticide to another. Usually, however, the shapes of the curves obtained for allethrin and DNC (triethanolamine) were much the same. The difference in the curve for HETP is ascribed to the ease of hydrolysis of this material.

More detailed investigations of the action and penetration of the insecticides were made with eggs of *Diataraxia*. Embryonic development continued after the application of toxic concentrations of any of the four poisons, except when the concentration of DNC (triethanolamine), allethrin and HETP considerably exceeded the minimum required to give 100 per cent. kill. The data indicated that whereas only two to three times this minimum inhibits development in the case of DNC (triethanolamine), the figure for allethrin and HETP is in the order of 50–100 times. Toxic concentrations of DDT did not inhibit embryonic development. When development was inhibited at an early stage by DNC (triethanolamine), the eggs turned brown and several small brown circles, apparently composed of yolk material, became closely applied to the chorion. With allethrin, the yolk contents became dark in colour and quite liquid; with HETP, the yolk contents were colourless and the chorion opaque.

Just prior to oviposition, the egg-shell consists of at least five different layers, comprising the exochorion (a fairly thin external layer, apparently composed of lipoproteins), a soft protein layer about 2 μ in thickness, the resistant endochorion (a proteinaceous layer 0·5 μ thick, the internal surface of which is very hydrophobic), a waterproofing layer of wax-like material, and the vitelline membrane. After fertilisation, changes take place in the last, and it is then referred to as the " vitelline-fertilisation membrane." A cement layer is deposited by the female on the chorion during oviposition, but the chorion of the laid egg otherwise appears to be the same as that of the unlaid egg in the oviduct. During embryonic development serosal membranes are formed below the chorion which reach their maximum development near the middle of the incubation period, when it was possible to remove the embryo, enclosed within them, from the chorion without apparent injury. It is considered that these membranes may hinder the penetration of insecticides to the embryo.

The results of dipping and washing experiments indicated that the resistance/age relationships found were due to a difference in the ability of the insecticide to penetrate the shell layers and membranes rather than to differences in the inherent susceptibility of embryos of different ages. When embryonic development continued after the application of the poison, death was most likely to occur either when the embryo had completed or nearly completed its development, but had made no visible attempt to hatch, or after hatching had been attempted, as shown by holes in the shell.

The speed of penetration of DNC (triethanolamine) into eggs of *D. oleracea* as determined in respiration experiments was very rapid irrespective of the age of the eggs. The poisoned eggs showed a marked initial rise in oxygen consumption, a greater increase being noticed in eggs

1–2 and 5 days old than in those 3 or 4 days old. Although the metabolism of these eggs was affected, the embryos continued their development apparently normally until reaching one of the two critical stages. It is suggested that the number of embryos that succeed in passing the critical stages and in hatching depends on the extent of the initial metabolic disturbance caused by the poison, which in turn depends on the amount of poison reaching the embryonic material. The shape of the respiration curves indicate that most of the poison reaches the embryo either soon after application or towards the end of the incubation period when the serosal membranes and fluids are resorbed. A close correlation appears to exist between the age at which the eggs show maximum resistance to the insecticide and the age at which the embryonic membranes are present at their maximum stage of development.

Williams (D. J.). **On a new Species of *Saissetia* (Hem.: Coccoidea) from Zanzibar.**—*Bull. ent. Res.* **44** pt. 3 pp. 581–582, 1 fig., 1 ref. London, 1953.

A description is given of the adult female of *Saissetia zanzibarensis*, sp.n., which is the Coccid previously recorded as an undescribed species of *Saissetia* on clove in Zanzibar and regarded as a possible vector if the causal agent of the sudden-death disease of that plant proved to be a virus [*R.A.E.*, A **38** 229]. Further research on the disease has shown that a virus is not involved. *S. zanzibarensis* is widely distributed in Zanzibar and Pemba, occurs on many plants in addition to clove, including mango, guava, coconut and *Citrus*, and is associated with ants. It has recently been collected in Tanganyika on mango, on which it was associated with *Oecophylla longinoda* (Latr.). Characters distinguishing it from *S. coffeae* (Wlk.) are included.

Miles (M.). **Studies of British Anthomyiid Flies.**—*Bull. ent. Res.* **44** pt. 3 pp. 583–588, 5 figs., 4 refs. London, 1953.

This further part of a series [*cf. R.A.E.*, A **41** 68, etc.] deals with Anthomyiids that attack onion and leek. *Hylemyia* (*Delia*) *antiqua* (Mg.), which is widely distributed in Britain, though absent from several districts where these crops have been cultivated for many years, is restricted to *Allium* spp., but *H.* (*D.*) *cilicrura* (Rond.) and *H.* (*D.*) *trichodactyla* (Rond.) (*cf.* **40** 198] are general feeders. The immature stages of these three species are similar, but the anterior spiracles of the larvae have 10–13 processes in *H. antiqua* and 5–8 in the other two. The eggs of *H. antiqua* are laid on or near the plants, whereas those of the other two species are usually distributed in freshly worked soil. *H. antiqua* is most likely to cause serious damage in spring and early summer, when it is most abundant and conditions are most favourable. *H. cilicrura* and *H. trichodactyla* are unlikely to attack spring crops, since the preparation of the seed-beds is usually completed before the adults oviposit and the practice of destroying weeds by means of herbicides obviates later disturbance of the soil. Damage to summer-sown onions in August and September is usually attributed to *H. antiqua*, but was caused by *H. cilicrura* and *H. trichodactyla* in eastern England in 1951 and can probably more often be attributed to them. Seed-beds for this crop are prepared in late July and early August, when adults of the third generation are emerging, whereas it is unlikely that young crops would attract *H. antiqua* from mature ones on which it is already established.

PAPERS NOTICED BY TITLE ONLY.

ALBRECHT (F. O.). **The Anatomy of the Migratory Locust** [*Locusta migratoria migratorioides* (R. & F.)] **. . . with a Foreword by J. W. Munro, C.B.E., D.S.C.**—10 × 7½ ins., xvi + 118 pp., 141 figs., 34 refs. London, Athlone Press, Univ. Lond., 1953. Price £1 10*s*. (Distributed by Constable & Co.)

BALACHOWSKY (A. S.). **Les cochenilles de France, d'Europe, du Nord de l'Afrique et du bassin Méditerranéen. VII. Monographie des Coccoïdea Diaspininae. IV. Odonaspidini—Parlatorini.**—*Actual. sci. industr.* [no.] 1202, 207 pp., 46 pls., 5 pp. refs. Paris, 1953. Price *Fr.* 1500. [*Cf. R.A.E.*, A **39** 292.]

FISHER (Sir R. A.) & YATES (F.). **Statistical Tables for biological, agricultural and medical Research.**—4th revd. edn., 11¼ × 8½ ins., xi + 126 pp., 66 refs. Edinburgh, Oliver & Boyd, 1953. Price £1 1*s*.

MERTIN (J. V.). **Pesticides Quarterly Supplement no. 6, May 1953.**—pp. 303–346, 90 refs., multigraph. [Canberra] Dep. Hlth. Aust., 1953. **No. 7, August 1953.**—pp. 347–400, 74 refs. **No. 8, November 1953.**—pp. 401–424, 54 refs. **Index to Supplements nos. 5–8, Feb.–Nov. 1953.**—*T.c.* pp. 425–431. [*Cf. R.A.E.*, A **41** 155, 224.]

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